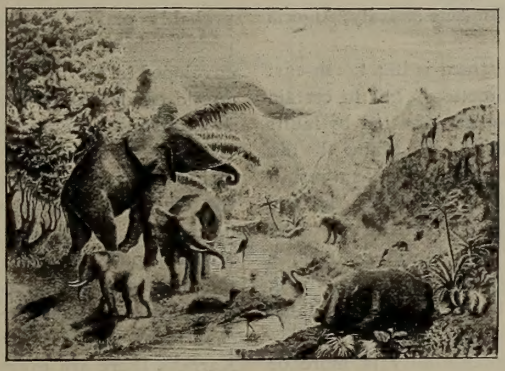
MALTESE CAVES AND THEIR FAUNA.

By John H. Cooke, F.L.S., F.G.S., Etc.

WHETHER regarded from an historic or from a prehistoric standpoint, there is no place in or around the Mediterranean which is so intensely interesting to the student as the Maltese Islands. Within the narrow limits of its rock-bound shores the naturalist has furnished an epitome of the physical history of the greater portion of the Mediterranean region from Eocene times onward. The historian finds the quint-essence of the histories of the peoples who have been engaged in struggles for empire in the countries around from the time when the Phoenicians first colonized the islands, 3000 B.C., to their occupation by the British in the early part of the present century.

The Maltese group consist of the Islands of Malta, Gozo and Comino, together with several small barren islets, the principal of which are Filfola and Cominotto. They are situated in the central Mediterranean at a distance of sixty miles to the south of Sicily and two hundred miles to the north of Cape Calipia, the nearest point in Africa. On the north they are connected with Sicily by a submarine plateau, the depth of submergence of which does not exceed seventy fathoms in any part. To the south a deep channel, having an average depth of 230 fathoms, and which is 190 miles long and from sixty to a hundred miles wide, forms a natural boundary between them and Africa.



Extinct Animals of Malta.*

Malta is the principal island of the group both in size and commercial importance, its greatest length being seventeen miles and its greatest breadth ten miles. Though less fertile than Gozo, its population is nearly eight times as large, an anomaly which is principally due to the fine harbours, where the greater part of the population, military, naval and commercial, have segregated.

Fifty years ago little or nothing was known of the natural history of the islands, but of late years great strides have been made, and the islands have upon more than one occasion furnished the key to some of the most important problems bearing upon the former physical history of the Mediterranean. In geology especially, the progress made has been most marked. The attention of geologists was first attracted to the islands by the cave discoveries of the late Admiral Spratt and the late Prof. Leith Adams; and again, at a later period, by the classic work done by Sir John Murray, of the "Challenger," in showing the relationship that existed between the Maltese rocks and the present deep-sea deposits. Geological work on the islands' rocks was rendered all the more interesting owing to the differences of opinion that had been expressed as to the division of geological time to which the Maltese strata should be assigned Spratt and Adams considered them as being of Miocene age, but Prof. Rupert Jones referred them to the Eocene. Fuchs, the eminent Austrian geologist, divides them into two parts, the upper of which he calls Miocene and the lower Oligocene. Sir John Murray, while agreeing with Fuchs' view, points out that a striking analogy exists between the microscopic sections of the Globigerina limestones of Malta and the sections of the Pliocene rocks of Sicily.

During a lengthened residence in the islands extending over many years, I devoted much time to Mediterranean geology, and have thus had an opportunity of personally investigating the material on which my predecessors had based their opinions. Briefly summed up, it may be said that, palaeontologically, the Maltese rocks offer strong resemblances to the Miocene beds of Tournay and Brittany; to the Black Crag of Belgium; to the Miocene beds of the Vienna Basin; to those of Dego, Calcaire, Belforte and San Ruffilo in Italy; the Marine Molasse of Hungary; the Sotska beds of Styria; the Pectunculus beds of Hungary, and the Miocene of Sicily and Algeria.

* *Elephas mnaidra, E. melitensis, E. falconeri, Gyps melitensis, Cervus barbarus, Ursus arctos, Cygnus melitensis, Tryonyx melitensis, Myoxus melitensis, Grus melitensis, Hippopotamus pentlandi.*

The following is a tabular summary of the Maltese rocks and their equivalents in the Vienna Basin:

	Formation.	Thickness.	Equivalent Vienna Basin.	Series.	
1.	Quarternary Deposits				
2.	Upper Coralline Limestone ..	250 feet ..	Leithakalk ..	Tortonian	Miocene
3.	Greensands ..	50 ,, ..	Grunder Schichten ..	Helvetian	Miocene
4.	Clays ..	30 ,, ..	Schlier ..	Laughian	Miocene
5.	Globigerina Limestone ..	200 ,, ..	Horner Schichten ..	Laughian	Miocene
6.	Lower Coralline Limestone ..	500 ,, (?) ..	Solszka Schichten ..	Aquitanian ..	Oligocene

The deposits thus arranged may be divided into three groups.

The first is composed of ossiferous breccias and valley drifts, and they are analogous to the Quarternary deposits of Nubia, Algeria, Candia, Sicily and Gibraltar.

The second comprises the various sub-divisions of the Upper Coralline Limestone, and resembles the Leithakalk of the Vienna Basin.

The third group is made up of the remaining beds, and answers to the Miocene of Italy, Algeria and Sicily.

The general dip of the strata is in a north-east and an east-north-east direction; but in certain localities it has been somewhat affected by faults and other local displacements. In Malta the dip is more pronounced than in Gozo, and, as a result, the contours of the northern coasts of the two islands present some striking contrasts. The strata of Malta shelve off at a low angle towards the north; and the shores are therefore low-lying and, when viewed from the sea, present a tame and monotonous appearance.

In Gozo the original horizontality is more or less preserved, and the coast-line there consists of an unbroken series of precipitous cliffs that impart to the shore-line an effect which is both bold and picturesque. These cliffs are composed of Lower Coralline Limestone, and, rising sheer from the water's edge, they tower to a height of between 300 and 400 feet above the waters of the Mediterranean. From the edges of their summits and falling back in gently undulating curves lie the Globigerina deposits, capped with sombre-coloured clays and golden-hued sandstones; while crowning the whole lay the variegated strata of the Upper Coralline beds, the mural precipices and craggy escarpments of which stand out in bold relief against the clear blue Mediterranean sky.

The terraced slopes that lie between these upper and lower cliffs offer some remarkable examples of the effects that atmospheric denudation has had upon them. From the escarpments along the hill-sides of the Binjemmas, and from the faces of the sea and the plateaux cliffs, huge masses of partly-detached rocks stand out at varying angles, and so unstable do many of them appear to be, that it seems as though but a touch is wanting to cause them to break away and to precipitate them into the valleys beneath. Examples of this kind are very common in both islands; but the cliffs of Dingli, Emtahleb, Fom-ir-Rih and St. Paul's Bay afford some of the best examples. Strewn along the bases of the escarpments in a state of the wildest confusion lie rock masses of every conceivable size and shape, all of which have at some previous time formed a part of the cliffs that now loom hundreds of feet above them.

Atmospheric agencies have contributed much towards this scene of destruction. Of these, frost probably played an important part during the period when the greater part of Europe was enveloped in a "mer de glace," and when almost Arctic conditions of climate prevailed around the Mediterranean, where temperate and even semi-tropical conditions now exist. But it is to the insidious sirocco and to the action of rain on the clay beds that the greatest amount of the destruction seems to have been due. Their attacks upon the sands and clays that underlie the limestone cliffs have undermined the latter, and have caused the rock to split and roll down the slopes. At Fom-ir-Rih, Ghain Toffiha and Karraba there are examples of areas consisting of several acres that have broken off, and have sunk to lower levels in consequence of the eroding action that the underground springs have had upon their unstable foundations. The south and south-western shores of Malta appear to have been more subject to these landslips than any other part of the islands, a fact that is due to the south-westerly dip of the strata between Carmola and Fom-ir-Rih. The beds in these localities have therefore a tendency to slide along their dip-planes, and hence, when their foundations are weakened, fractures of considerable extent occur. The regularity with which these downthrows take place is strikingly shown by the Phoenician cart-tracks that skirt the summits of the southern cliffs. Many of these, after traversing the islands for some distance inland, trend towards the coast, and there break off at the very edge of the cliffs.

Such are the main geological features of the islands, the appreciation of which are necessary for the understanding of the succeeding details of the subject of these papers. Like all limestone districts, the Maltese strata present many evidences

of their susceptibility to the erosive action of rain and the atmosphere. The gorge sides and cliff faces are everywhere pierced with caverns and fissures, few of which, however, attain to any considerable size. This is due to the nature of the rocks in which they have been formed, as, owing to the comparative softness of the limestones, the caverns usually collapse when they reach a certain limit.

Examples of the former class occur all round the coast lines of the islands, but they are to be seen to the best advantage wherever the Upper Coralline Limestone appears at the sea-level along the coast. The varied and romantic scenery of the western coast of Comino owes its picturesque character entirely to the beetling crags and cavernous hollows with which its shore cliffs are everywhere adorned. Compared with the cliffs of

MAP SHOWING THE RELATIONSHIP OF THE MALTESE ISLANDS TO THE CONTINENTS OF EUROPE AND AFRICA.

Maltese caverns may be divided into two classes, those that have been formed by the mechanical erosion of the sea, assisted by the chemical processes of the atmosphere, and those that owe their origin to the wasting effect of rainwater saturated with carbon dioxide, which percolates through the porous strata, or obtains access through the fissures or along the bedding planes of the rock.

Gozo and those along the south coast of Malta, Comino's crags may appear insignificant; but their want of altitude is fully compensated for by the wildness of their surroundings and the picturesque groupings of their caverns and of the detached rock masses that lie along their bases. The resistless onslaught of the battering forces of the Gregale and the Levante, two winds that alternately rage in the Mediterranean during the

winter months, has everywhere left evidences of the vast amount of destruction they are capable of effecting. From Comino's cliffs rock masses have been torn away, and hurled seaward to incredible distances, thus forming a series of sunken reefs, and fastastically shaped islets, which in tempestuous weather are both the refuge of the myriads of gulls and rock pigeons that have there made a home and the dread of the fishermen who eke out a scanty livelihood by toiling in the surrounding waters. It is chiefly to the north-east wind that these effects are due. This wind blows during the winter time with unremitting fury for many days together, and one has but to watch the huge breakers that are then raised and hurled against the cliff faces of the isles to realize the magnitude of their power and the amount of destruction they are capable of effecting. The atmosphere, too, takes no mean part in these operations; but its efforts are chiefly confined to the softening down of the angularities caused by the fractures and displacements.

The Maltese Islands are the only remnants now left of the land barrier that once stretched across the Mediterranean and connected Italy with Tunis. A comparative study of the fauna and flora of southern Europe and of northern Africa first suggested to Heer the connection that formerly existed between the two continents at this point; and his conclusions were afterwards borne out by the interesting evidences that have been forthcoming from the breccias and bone-caves of Sicily and Malta. Prof. Gervais (1) pointed out the similarity that existed between the genera and species of the living Insectivora in the north of Africa and those in southern Europe; and Prof. Dawson (2) observed that the porcupine of Algeria presents no distinctive characters of sufficient importance to justify it being regarded as a different species to the European one. The tailed batrachians that are now found on either side of the Mediterranean and the persistency with which the birds of this region follow year after year the same line of migration also offer themselves as further evidence of the land passage that once existed here. The inferences to be drawn from the above facts have been corroborated by the work of the Admiralty Survey in the Mediterranean.

Between Sicily and Malta there are two banks, and their elevation to a height of but forty fathoms would again create a passage of dry land between the two islands. Between Malta and the African coast the soundings show a depth of 344 fathoms, and an elevation to this extent would form a broad isthmus between the two continents of which Malta would be the centre. That such an elevation of this part of the Mediterranean region occurred in time past is shown by the moraines and other evidences of glacial action that are now to be seen among the mountains of Lebanon, Anatolia (3), and of the Atlas. Alluding to these phenomena, Dawson (4) computes the elevation to have been between 6,000 feet and 7,000 feet, while Professors Ramsay and Geikie (5) consider an upheaval of from 1,500 feet to 2,000 feet to have been sufficient to have effected the same results.

The palaeontology of the Pleistocene beds of Malta and of the neighbouring land areas offer interesting evidences on the question. The caves of Italy, Sicily and Malta abound with fossil mammals of a purely African type. The remains of *Elephas africanus* have been found in quantities in the caves of Syracuse, of Palermo, and of San Teodoro, and intermingled with them were the bones of two species of African hippopotami (6). The presence also of the bones and teeth of *Elephas antiquus*, and of *Ursus ferox*, a bear whose remains occur in abundance in the caves of Gibraltar, Provence, Mentone and Sicily, afford evidences of this elevation and indicate a connection between Sicily and Europe prior to the formation of the Straits of Messina. The Maltese-Sicilian isthmus that connected the two continents afforded the means for migration to animals and plants alike. Further, as the remains of animals of a distinctly African type are at the present day to be found in Europe, so are the remains of European types to be found in Africa. M. Bayle (7) described a stratum of clay, which he found at Mansourah, in Algeria, and with the assistance of Prof. Gervais, it was shown that the remains found in it included the molars and bones of *Elephas meridionalis*, an elephant which in Pleistocene times had its headquarters in northern Italy, but which had roamed as far south as Algiers, by way of Malta.

The bone breccias and caves of Malta have added very largely to our knowledge of the nature of these physical changes. The cliffs that encircle the islands' plateaux, and the mural escarpments of the gorges are honeycombed with caverns and fissures, many of which have yielded a rich and varied collection of the remains of extinct Pleistocene birds, reptiles and mammals. From the gorge-caverns, and from the breccias that fringe the south-eastern shorelines of Malta, the late Admiral Spratt and the late Prof. Leith Adams obtained the remains of three distinct species of elephants, *Elephas mnaidra*, *E. melitensis* and *E. falconeri*. The last was, when full grown, not larger than a donkey.

(1) Gervais: "Animaux Vertébrés Vivants et Fossiles," p. 48.

(2) Dawson: "Cave Hunting," p. 380.

(3) "Nature," vol. v. p. 444; vol. vi. p. 536.

(4) Dawson: "Cave Hunting," p. 380.

(5) Ramsey, A. C., and Geikie, J.: "The Geology of Gibraltar," Quart. Journ. Geol. Soc., vol. xxxiv. p. 537.

(6) Falconer: "Palaeontological Memoirs," vol. ii. p. 543.

7) Bul. Soc. Geol. Fr., 2d ser. tome xi. p. 204.

The remains of a pigmy species of hippopotamus, *Hippopotamus pentlandi*, have been found in great abundance in nearly every part of the island. The geographical range of this river horse seems to have extended as far east as Peloponnesus; and it has been found in such quantities in the caves of Palermo that its remains were exported by the shipload for the manufacture of lamp-black. Bears, foxes, wolves, deer, dormice as large as guinea-pigs, huge tortoises equal in size to those now found in the Galapagos Islands, lizards larger than those now found in northern Africa, chameleons, and an assortment of the remains of monster swans, vultures and other birds, are a few of the many relics of Malta's past that have been unearthed from the Pleistocene deposits of the islands.

(*To be continued.*)

VESPA AUSTRIACA, A CUCKOO-WASP.

By Charles Robson.

TOWARDS the close of 1897, as I was naming my few specimens of social and solitary bees with the aid of Mr. Saunders' beautifully illustrated work (1), I thought I would pass in review my social wasps (Vespae) in the light of his descriptions and illustrations of the several species. I had already named them, when engaged more especially upon their study in the early eighties, from Ormerod's monograph (2), than which one needs no better introduction and guide. Whilst thus occupied, great and agreeable was my surprise to find that I was in possession of a handsome perfect female, or queen, of the comparatively rare *Vespa austriaca* Panz. = *arborea* Smith, which had been taken late in July, or in the beginning of August, 1887, at Harnham, Northumberland, and from its close general resemblance to a young queen of *V. rufa*, Linn., had been put aside as such in my collection of unmounted insects. I found also a second though sadly mutilated female of the same species which had been obtained under peculiar circumstances on July 22nd in the same year and at the same place, and which was the only wasp I had that season mounted. Saunders in his work says (pp. 148-9) that "the habits of *V. austriaca* Panz. (= *arborea* Smith) are not yet fully understood, only males and females are known; and Schmiedeknect has suggested the possibility of its being an inquiline species living with other wasps, as *Psithyrus* does with *Bombus;* but at present I think there is no direct evidence to prove this, although the theory is ingenious and very far from improbable." On reading this I was something more than disgusted to find what a splendid possible opportunity I had lost of having been enabled to fully and satisfactorily determine this moot point, as well as having, I believe, been the first to capture the male of this wasp in Britain; since heretofore, according to Saunders (p. 155), "only females have occurred in Britain" (3). For, the above-mentioned dead and mutilated female or queen of the *V. austriaca* I had seen dragged out from the burrow leading to the nest cavity of a colony of the *V. rufa* by one of the workers, and had secured both insects as soon as they were wholly free of the entrance; though at the moment I only thought this was the foundress, or queen *V. rufa*, of the nest, which had died from disease or exhaustion and was thus being disposed of, as my notes on the subject quoted as follows will show.

"July 22nd, 1887.—To-day, at 3 p m., as I sat by the side of the nest of the *Vespa rufa* in the east dyke of the hayfield, I observed a worker-wasp dragging out with much labour another wasp; and on securing it and its burthen, I found the latter to be the headless, wingless and forelimbless carcase of a queen wasp, which was still soft and limp. Just a stump of the wings remained, they having obviously been bitten off. Is it the carcase of the foundress queen? Has she died and been decapitated and otherwise mutilated in the endeavour to remove her from the nest? If so, and other of the large, for they are here large and handsome, imperfect females or workers are constrained to lay ova, we shall probably only have drone brood in time, unless perfect female or queen brood is already in the comb. Possibly, however, the queen is spent, and the colony nearing its consummation. Nevertheless, food is being carried in, and substances out, briskly; and the nest is a fairly strong one. The hole of entrance to the nest cavity, or mouth of the burrow, is nearly circular, and is about three-fourths of an inch in diameter."

So much for my first note on the subject. The nest was allowed to remain undisturbed, the intention being to secure it, if possible, later on in the season, when perchance it might reveal something interesting relating to parthenogenesis, illustrated in this instance by the development of male or

(1) "The Hymenoptera Aculeata of the British Islands," by Edward Saunders, F.L.S., London, 1896.

(2) "British Social Wasps;" by Edward Lathom Ormerod, M.D., London, 1868.

(3) We believe a male of this wasp was taken by the Rev O. Pickard-Cambridge in Dorsetshire and recorded September, 1856 (vol. vii. p. 212, Ent. Mon. Mag.).—J. T. C.]

drone brood from the unfertilized ova deposited by the worker wasps of the community. From former observations I was fully convinced that ova were laid in what Ormerod styles "secondary" nests, *i.e.* nests built after the original ones with their queen had been destroyed by the worker wasps, not only of the present species, but also of the *V. britannica* and the *V. sylvestris*. Further, that from such ova larvae might hatch out. However, circumstances induced me to take this nest much too soon to admit of anything definite being made out respecting this phase of parthenogenesis, except the fact that ova had been laid by one or more of the worker wasps, and that some of the tinier larvae, at least, had in all probability been hatched from such ova.

My next note runs: "August 2nd, 1887.—On July 22nd (eleven days ago) I observed a queen rufous wasp (*Vespa rufa*), dead and mutilated, being borne out by a worker from a nest of this species in the east dyke of the hayfield. To-day I have dug into the hedge-bank and discovered the nest, no wasps either coming or going whilst I was thus engaged. The nest, only a small one, was built well back into the hedge-bank. The burrow leading to it was nearly circular, of uniform diameter, and about three-fourths of an inch wide. It is nearly spherical, somewhat drawn out at the bottom, and is three and a-half inches in diameter, with the circular hole of entrance a little on one side at the bottom, scarcely three-eighths of an inch diameter on the outside, and not more than a quarter of an inch diameter on the inside. In fact, the hole on the inner side of the nest or case would no more than admit the passage of the queen wasp. The nest was attached to the very abundant fibrous roots of the grasses at the summit, and on the inner side towards the summit of the nest-cavity. So firmly was the nest secured to the roots on the inner side in its upper part, that the walls there were torn away when it was very carefully drawn out of its cavity. At the bottom and in the front part of the nest cavity there was, as is always the case when the cavity has to be mined out to admit of the gradual growth of the nest, an equal space between it and the nest large enough to allow the wasps to creep around on the outside of their nest in their operations of mining and building. The nest contains only two tiers or platforms of comb, the uppermost one being two and a-half inches diameter and the lower one two inches diameter. Both tiers are near upon circular. In it were four young queens, or perfect females, quite recently emerged from their cells, forty-four drones, or males, and a few workers. In all I obtained twenty-one workers in and at the nest, many returning after the nest was dug out. No old, or foundress, queen was present; hence the defunct one carried out of this nest on the 22nd July was undoubtedly she. From the present condition of the colony I should imagine that she was spent, since the innermost twelve cells of the bottom tier of comb are queen cells, and the next forty cells are, from their smaller size and less height, obviously drone cells; whilst the succeeding gradually-decreasing-in-size larvae, from full-grown within to very small without, are probably also drone brood. The four central cells or cocoons are vacated undoubtedly by the four young queens found in the nest. Of the forty cocooned drone cells immediately succeeding the queen cells none are vacated. The four central vacated queen cells again contain ova, one to each; hence there can be no doubt that one or more of the workers or imperfect females have laid ova. Possibly the smaller larvae in the rudimentary cells at the perimeter or extreme margin of the comb are also from worker ova, if not some of the larger larvae nearer the centre of the tier. None of the cells in this tier that now contain larvae or pupae have been before tenanted, but are occupied for the first time only. Hence, the upper and earlier-built tier of comb must have given birth to the numerous drones present. The larvae have their ventral surface and mandibles directed towards the centre of the comb; and they are very decidedly buff in colour, sometimes even inclining to orange, as is usual with this species of wasp. All are healthy and lively. In the upper tier of comb one-half of the cells are vacated, very many contain drone nymphs or pupae; whilst some, both within and without, at the margin, again contain larvae. There are some small rudimentary, never-before-used cells on the perimeter, a few of which contain tiny living larvae, and others the dried-up remains of tiny larvae or ova, probably both. On the margin of the second or lower tier of comb are similar cells with similar contents; hence it is exceedingly probable that a worker or workers have deposited ova in these outermost cells that are thus occupied. This nest, or colony, is, notwithstanding the death of its foundress queen, still in full swing, though the workers are few; but it has apparently reached its full limits. Eleven of the forty-four drones have quite recently emerged from their cells or cocoons; but the workers are all old, as they are well-matured. Hence, there being no vacated drone cocoons in the second or lower tier of comb, and the four central vacated queen cells are empty for the first time, it is obvious enough that the numerous drones must have emerged from the top tier, and that from these same cells must have emerged the workers at an earlier stage. No pupae or nymphs of workers are present."

This particular nest of the *Vespa rufa* I preserved, along with a few others taken subsequently, as well as a goodly selection of the wasps appertaining

thereto, packed in layers in boxes, between sheets of blotting-paper, for the purpose of comparison and study, and brought away when I returned home in the middle of August. Unfortunately, a removal from town to country, and from a dry house to a damp, followed by a long period during which it was impossible so much as even to look over my collections, resulted in moth and mite and mould and woodlouse (*Atropos*) making such havoc amongst them all that nearly the whole were lost; in fact, only a sorry remnant was left, and the labour of very many years was more or less entirely wasted. Fortunately, however, though all the wasps layered in boxes were thrown away, most of my wasps' nests were retained, or as much of them as their would-be destroyers had left, and were again carefully baked in an oven to destroy the pests and preserve the remnant. Otherwise the following observations on the relationship existing between the *V. austriaca* and the *V. rufa* would have been impossible.

On thinking over the subject of the possible parasitism of the *V. austriaca* upon other species of Vespae, as suggested by Schmiedeknect, it seemed most probable that, such being the case, the rufous wasp (*V. rufa*), with its milder temper and frequent comparatively small communities, would be the more likely of the species to have thus imposed upon it the rearing of the brood of the cuckoo-wasp. The imposition would be assisted by the close general resemblance of the parasite to the host—of the pseudo *Vespa* to the true *Vespa*. Further, where from the loss of the queen, from accident or disease, the main-guard to prevention of access to the cells was removed, there would probably be little if any opposition on the part of the workers to prevent the parasite from attaining her ends, as the probability is they might not even detect the fraud. In this case it would be but an instance of one individual entering in upon the labours of another and utilizing them for its own benefit. Such would be of not infrequent occurrence in the parasitism existing between the *V. austriaca* and other species of Vespae, as it undoubtedly would be in the similar form of parasitism existing between the pseudo humble-bees (Psithyri) and the true humble-bees (Bombi). This scarce admits of a doubt, since vast numbers of both queen Vespae and queen Bombi are destroyed annually, and their nests thus left open to the intrusion of their several inquilines and enemies.

Consequently, it was not without some little feeling of excitement that I began to examine the nest of the *Vespa rufa*, from which I had seen borne, fully ten years previously, the mutilated carcase of a female *V. austriaca*, to find what it might possibly reveal about the latter species of wasp as an inquiline. I commenced on the eight large and perfect female or queen cocoons in the central region of the second and lower tier of comb which surrounded the four already vacated similar cells in the very centre. My delight and satisfaction may be imagined at finding, as cap after cap of the several cocoons or cells was cut open, that beneath them lay concealed the heads of perfect females or queen *Vespa austriaca*, with their characteristic yellow-scaped antennae and three-spotted "subdentate" clypeus. At least in six instances this was so out of the eight; and in three of these the imago was fully developed, with wings expanded and all parts of the body divested of the pupal pellicle, having been, when death overtook them, on the eve of emergence from their several cells or cocoons. The seventh nymph, or pupa, had had its head entirely consumed, and the thorax with appendages much disfigured by one or more of the pests of collections already enumerated, but the abdomen was intact, and its colours and characters were unquestionably those of *V. austriaca*. The eighth nymph was much younger, and its colours were not yet evolved; but there is no reason whatever to doubt that it, too, is an *austriaca*, as would be in all probability the four young females that were in the nest when it was taken on August 2nd, 1887, which had but recently emerged from the four vacated central cells.

Turning my attention now to the male or drone cocoons immediately succeeding and surrounding the female cells, I found many of them to contain the distinguishable remains of nymphs or pupae; but in none of even the furthest developed of these pupae had there yet been any evolution of the colours, whilst many of them had had their inmates reduced to powder by mites and mould. On the extreme margin of the series one or more of the spinning-up larvae had not yet got finished the silken cap or covering to the cell when the nest was taken, and they were destroyed.

Next laying open and examining the numerous drone cells occupying an intermediate zone of two and three cells' depth in the upper tier of comb, they were found in several instances to contain drones of the *V. rufa*, with their colours and distinctive markings fully evolved, and in two instances at least with the wings expanded and body freed of the pupal pellicle. In other cases the pupae were younger, and their colours were not yet evolved; whilst in very many the inmates of the cocoons were more or less reduced to shreds and dust. The wonder perhaps is that anything in the shape of wasps remained after so long an interval and under such circumstances.

Thus far I had been disappointed in my search for identifiable remains of the male sex of th *V. austriaca;* and there now only remained a much broken zone of one cell depth of unvacated cocoons on the outer edge of this, the upper tier

of comb. Here, however, at last, was ample reward; for though their number did not exceed a score, the inmates of a dozen of them had their colours and marking sufficiently evolved to clearly distinguish them as of the species *V. austriaca*. Four of them, indeed, had their wings expanded and body divested of the pupal pellicle. As with the females, so it was with the males, the distinctive character of the clypeus, when the cap of the cocoon was cut open and the head of the occupant revealed, at once indicated the species, it being here *immaculate* and with its lower margin "sub-dentate."

From the foregoing inventory of this small nest of the *V. rufa*, in part made when the nest was taken and in part subsequently, it would appear either that some fatality had overtaken the foundress queen at an early period in the history of the community, that one or more of the workers had then commenced to lay ova from which male or drone brood developed, and that subsequently the parasitic or inquiline *V. austriaca* took possession of the nest, and commenced to oviposit in conjunction with the workers of *V. rufa;* or, that the queen *V. rufa*, being imperfectly impregnated, or diseased, had commenced early to lay unfertilized ova from which drone brood only was evolved, and had then succumbed to natural decay, disease or accident, or had possibly lost its life in combat with the usurping and succeeding *austriaca*, and had finally, like its successor, been dragged out of the nest. That workers of the *V. rufa* had deposited ova in the later part of the history of this mixed community was obvious enough from the presence of ova in the four very recently vacated queen cells. That the nest had been founded by a queen *V. rufa* was also obvious from the fact of workers and drones of that species being present, as well as from the structure of the nest. Whilst the fact of *V. austriaca* having usurped the nest and utilized the energies of the workers of *V. rufa* in rearing her brood of males and perfect females, was made more than apparent by the presence of that brood, and the fact of the economy of the nest being normally carried on for fully eleven days after her decease, and the removal of her body from it.

Vespa austriaca being thus shown to be a parasitic or inquiline species consisting of males and females only, it will be scarcely philosophic to allow it to remain in the genus *Vespa*. This difference in habit and constitution will almost certainly be found to be correlated with some more or less profound modification of structure. Such is the case in *Psithyrus* (*Apathus* Newman), undoubtedly a degenerate and modified *Bombus*. The same habit and constitution of parasitism and sex are found to be correlated with an absence of the bee-bread conveying apparatus or corbicula and the wax-plate extractors or nippers. The loss of the latter, most probably accompanied with a degeneracy or absence of the wax-secreting glands or organs, disqualifies this pseudo *Bombus* for the building of cells, as the lack of the former does for the conveyance of food. Consequently it is also disqualified for the rearing of its own young, as is practised by the host, the true *Bombus*, upon which it imposes the rearing of its progeny.

Given a sufficient quantity of fresh material—healthy spring females—to work upon, it would be probably found that there was some very considerable deterioration of the salivary glands, as compared with the true Vespae, which incapacitates *austriaca*, the pseudo *Vespa*, for paper-making. Saliva is the first essential towards the founding or building the nest as constructed by the genus *Vespa*. The demands upon the functional powers and activity of the saliva or mucus-secreting organs must be great indeed, as may readily be appreciated by watching a *Vespa* engaged in rasping or gnawing off fibres of wood from a weathered but sound pale or post. It has to moisten liberally the portion operated upon with the secretion as the process of gnawing proceeds; consider also the demands that are necessarily made upon them in the subsequent working up of the pellet of fibres into paper pulp, and in its application to the case or covering and cells of the nest. Hence, the parasitism of this wasp *austriaca* upon *Vespa*, from whom one need scarcely question she has descended, and from whom she will most probably be gradually more and more differentiated as a result of this different mode of life. In her we have an example of a comparatively recent or modern differentiation or evolution of a species and genus, a genus, so far as I am aware, yet to be named, and rightly founded on this difference in habit and constitution. The most probable correlated modification of structure will be, that the mandibles are somewhat smaller and less rugged, and the ligula or tongue is smaller than in the *V. rufa*.

Frederick Smith, in his description of *V. arborea* [4], of which he was the discoverer in Great Britain, thus describes it in 1837: "The same size as *V. rufa*, female, and similarly coloured, but having very rarely any tinge of rufous; the clypeus more produced, emarginate, and the angles subdentate, never having a central line, but only three minute dots; it also differs from *V. rufa* in having the legs stouter, longer, and very pubescent; the colour of the abdomen is different, being sulphur-yellow; the crown-shaped spot above the clypeus is larger, and deeply notched above; the

[4] "Catalogue of British Fossorial Hymenoptera, Formicidae and Vespidae, in the collection of the British Museum," by Frederick Smith: London, 1858. The name *austriaca*, of Panzer, was given last century to this species, so, being the earlier, supersedes Smith's *arborea*.

first segment of the abdomen is visibly longer." This is an exact description of the female *V. austriaca*, to which might perhaps be added that the greater degree of pubescence on the legs applies to the outer side of all the tibiae. These are clothed with long black pubescence, similar to that clothing other parts of the insect, but which is not present on the tibiae of *V. rufa*. The puncturation on all parts is finer, but more especially observable on the clypeus and the four posterior abdominal segments *ventrally*. The apical ventral segment or plate is more parallel-sided, and is somewhat contracted or shouldered before the emarginate apex. The mandibles are smaller and less rugged, the clypeus is smaller, and of less width across the apex; and the ligula or tongue is very distinctly smaller than than in *V. rufa*. The abdomen is more spindle-shaped, due in part to the greater length and the contraction anteriorly of the first abdominal segment. Then there is the greater comparitive width of the second segment, and the first abdominal segment is less abruptly truncate at the base than in *V. rufa*. The scape of the antennae is yellow in front, and the three black dots on the middle of the clypeus are arranged in a triangle. Length is 0·70 inch.

In the male *austriaca* the scape of the antennae is also yellow in front; but the clypeus is *immaculate*, and its lower angles, though still dentate, are less produced. The pubescence on the outer side of the tibiae is sparser, and the black spot on the middle of the first abdominal segment, instead of being button-shaped, as in the female, is lozenge-shaped. All other points of difference enumerated as existing between the female *Vespa austriaca* and *V. rufa* exist also between their respective males; except in the form of the apical ventral plate of the abdomen and the puncturation of the abdomen ventrally, which is absent in the male *austriaca*, and is of varying intensity in the male *rufa*, though never so abundant or so coarse as in the female form of that species. Length is 0·50 inch.

The genital armature pretty closely resembles that of the male *V. rufa*, but is not identical with it; the entire organ is narrower and much more parallel-sided. The stipites are more closely approximated in the median line dorsally, whilst the semi-membranous ear-like appendage at their apex is larger and stands outwards at a greater angle. The scoop-like united sagittae closely resembles the same part in the *V. rufa*—is parallel-sided, rounded at apex, and with the convex side *upwards* or dorsally set; whereas in *V. vulgaris* and *V. germannica* the united sagittae form a ladle-like instrument, the head or cup of which has the convex side *downwards* or ventrally set.

Killingworth, Newcastle-on-Tyne,
July, 1898.

PISIDIUM NITIDUM
VAR. LATERALIS.

By C. S. Coles.

IN April last I took from a small weedy pond near here a number of a *Pisidium* which I considered to be *P. nitidum;* but not being satisfied as to their identity, I submitted examples to Mr. L. E. Adams, of Stafford, for his opinion of them. That gentleman has informed me that they are really *nitidum*, but not of the typical form, differing therefrom in not being sufficiently round at the lower margin, and the umbones not central enough. That opinion has been confirmed by Mr. Taylor, of Leeds, who has also examined the specimens.

I have since visited the pond, and found the shells tolerably abundant, some of them of large size, but all preserving the above characteristics. The typical form was not obtained.

I propose for the above variety of *P. nitidum* the name of *lateralis*.

I observed that the finest specimens inhabited a small grassy cutting at the margin of the pond, where the water scarcely covered the bottom, in which the scoop could only be worked with difficulty, and amongst my captives were a fair sprinkling of *P. roseum*, many of them being also of large size, and these frequented the same cutting as the former species.

The only other mollusca inhabiting the pond, as far as I have investigated it, are *Planorbis complanatus* (common) and *Sphaerium lacustris*, together with a solitary specimen of *Helix hispida*, which put in an appearance amongst the weeds, etc., dragged from near the centre of the pond. That may, however, easily have travelled to where it was found, from the margin, along the weedy surface, and thence into my scoop.

Hoe Moor House, Hambledon, Hants.
June, 1898.

Collecting with Surface Net.—Prof. C. A. Kofoid, says "Science," has recently been discussing the Hensen method of collecting. This method of sweeping the plankton consists essentially in drawing a silk net vertically through the water. Its accuracy depends upon the efficiency of the silk in really catching the organisms. Experiments at the Illinois Biological Station show, however, that the leakage is great. The method is satisfactory only for the larger forms, such as the Entomostraca and the larger Rotifera and Protozoa. For the smaller and often very abundant "planktonts," such as *Melosira, Peridinium, Dinobryon, Raphidium, Scenedesmus, Euglena, Trachelomona* and *Chlamydomonas*, the Hensen method is wholly inadequate. Of 767,556,000 planktonts retained by the Berkefeld filter per cubic metre, only 248,200 organisms per cubic metre were retained in the silk net. This loss by leakage, says Prof. Kofoid, is of prime importance, for it is composed very largely of minute algae, which constitute a fundamental link in aquatic life.—*J. H. Cooke.*

ARMATURE OF HELICOID LANDSHELLS.

By G. K. Gude, F.Z.S.

(Continued from p. 17.)

Plectopylis repercussa (figs. 78*a–i*), from Tavoy, Burma, was described by Dr. Gould in the "Proceedings of the Boston Society of Natural History," vi. (1856), p. 11; but as the diagnosis is somewhat vague and as the species was not illustrated, subsequent authors have considered it to be synonymous with *P. achatina*, from which species, however, it differs in outward appearance as well as in its armature. The shell is sinistrorse, disk-shaped, pale corneous, finely striated, the upper side being strongly decussated by spiral lines, almost obsolete at the side, but reappearing in the umbilical region. The spire is a little raised, the suture linear. There are seven regularly coiled whorls, which increase slowly and gradually, and are flattened above and tumid below. The last whorl is tricarinated, one keel being at the periphery, one above, and another below (in young shells these keels are provided with a fringe of coarse hairs); this whorl widens suddenly at the aperture, where it is deeply deflected. The aperture is almost horizontal, elliptic cordate; the peristome white, thickened, and strongly reflected; the margins united by a raised flexuous ridge, slightly notched above and below at the junctions. The parieta armature is very complicated, being of the same type as in *Plectopylis karenorum*, described and illustrated in this series of papers (Science-Gossip, N.S. iii. Feb. 1897, p. 245, f. 35). These two species, together with *Plectopylis achatina*, *P. anguina* and *P. linterae*, to be considered afterwards, form a distinct group, connected with the group of *P. ponsonbyi* by a transition form, represented by a single specimen as yet undescribed, received by me from Mr. Robert Cairns, of Hurst, Ashton-under-Lyne. A long, stout, horizontal median fold, given off at the apertural ridge, proceeds parallel with the last whorl for a quarter of the length of that whorl, when it gives off a shortly descending, slightly reflected arm, provided anteriorly at the lower extremity with a short, abruptly descending horizontal ridge; the fold then rises obliquely for a short distance, and finally bifurcates; *the lower arm of the bifurcation the shorter*, and descending almost vertically; it is provided posteriorly with a short horizontal ridge at its

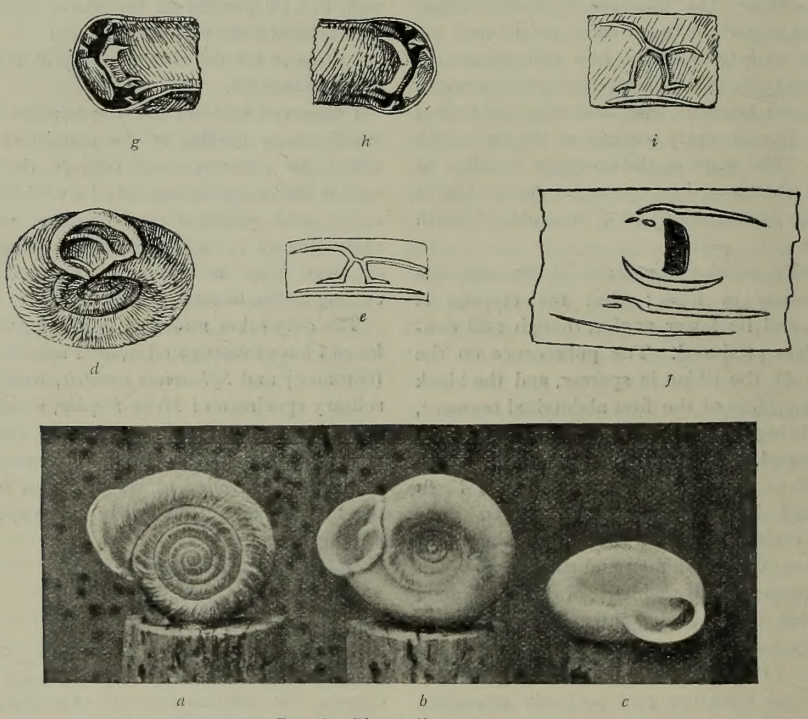


Fig. 78.—*Plectopylis repercussa*.

lower extremity; the upper arm at first ascends obliquely, then proceeds horizontally close to the suture, and gradually attenuates. Below these complicated structures, there is a free, thin, horizontal fold close to and parallel with the lower suture, and extending from the aperture to a little beyond the lower arm of the bifurcation and its posterior support (see fig. 78*e*, which shows part of the parietal wall). At the aperture this fold is *distinctly united to the transverse sinuous ridge* (see fig. 78*d*). The palatal armature consists of: first, a strong long horizontal fold near the suture and parallel with it, as well as with the posterior portion of the upper arm of the parietal bifurcation, with which it terminates at the same point posteriorly; secondly, a shorter, but much stronger and broader horizontal fold, which deflects with a terior half, with the concave side facing the vertical plate (see fig. 78*f*, enlarged, which shows the inner side of the palatal wall with its folds and denticles). Figs. 78*g–i* (also enlarged) show an immature specimen of five and a-half whorls, in Mr. Ponsonby's collection; the armature is almost identical with that of the mature specimens, but the main median parietal fold is very short and does not rise from the aperture, while the denticle in front of the lower part of the palatal vertical plate is very strongly developed, and it is united to the plate, so as to form a steep ridge. A second set of barriers, identical in every respect except in being a little smaller, occurs in this specimen one-quarter of a whorl further back. The mature specimen shown in fig. 78*d* is also in the collection of Mr. Ponsonby, and measures: major diameter, 31 milli-

Fig. 79.—*Plectopylis anguina*.

sharp curve posteriorly, having a little above its posterior termination, and almost in a line with its anterior portion, a slight elongated horizontal denticle; thirdly, a very short, but strong and broad crescent-shaped fold, deflected at both extremities; fourthly, facing the concave side of the last-mentioned fold, is a very strong and broad vertical plate, strongly inclined towards the aperture, with a much reflexed and thickened edge; this plate intercalates between the two lower arms of the parietal armature; on the posterior side of the plate and near its lower extremity occurs a stout little denticle, and a little lower and still farther back is found a slight elongated swelling, not amounting to a fold or denticle (yet present in all four mature specimens, as well as in an immature one, examined by me); fifthly, a thin horizontal fold, the anterior part straight, but curved in the posmetres; minor diameter, 24 millimetres; altitude, 9 millimetres; while the immature specimen measures 17 millimetres in diameter. Three specimens in my collection measure respectively 29 : 23 : 9 millimetres, 25 : 20 : 8·5 millimetres, 23 : 18 : 7·5 millimetres. The types of the species are in the New York State Museum, at Albany, N.Y., and are shown in figs. 78*a–c*, which are reproduced from the photograph kindly supplied by Dr. Merrill. The following particulars are taken from Dr. Bagg's notes which accompanied the photographs: "*Helix repercussa*, Gould. Burmah. Catalogue No., 236; original No., A 564. Major diameter, $1\frac{1}{8}$ inch [= 28·5 millimetres]; minor diameter, $\frac{7}{8}$ inch [= 22 millimetres]; altitude, $\frac{5}{16}$ inch [= 8 millimetres]; greatest diameter of aperture, $\frac{7}{16}$ inch [= 11 millimetres]." Dr. Gould states that the species was taken in the

Mergui Archipelago, but as this has never been confirmed it may be assumed that the collector, the Rev. J. Benjamin, made a mistake as to the locality. Mr. W. T. Blanford gives also the following localities: Moulmain and Tenasserim (in "British Burma Gazetteer," 1879, i. p. 709).

Plectopylis anguina (figs. 79*a-f*), from Tavoy, Burma, was described by Dr. Gould in the "Proceedings of the Boston Natural History Society," ii. (1847), p. 218; and it was figured in Hanley and Theobald's "Conchologia Indica," t. 13, f. 7. By some authorities this species has been considered identical with *P. achatina*. It appears, however, to be perfectly distinct. The shell is sinistral, much flattened, discoid, varying in colour from corneous to dark chestnut; below it is usually paler and flammulated with dark chestnut; it is finely striated and decussated by microscopic spiral lines. The spire is depressed, the suture linear. There are five and a-half regularly coiled whorls, which increase slowly and gradually; they are a little flattened above and a little rounded below. The last whorl is slightly angulated at the periphery; it widens rather suddenly at the aperture, and is deeply deflected in front, and somewhat constricted behind the peristome. The umbilicus is extremely shallow; in a specimen in my collection it is only 1·5 millimetre in depth. The aperture is nearly horizontal, cordate; the peristome is livid or pale brown, a little thickened and much reflexed. A sinuous raised ridge on the parietal wall at the aperture connects the margins of the peristome; at the junctions above and below, however, there are slight notches. The armature is similar in most respects to that of *P. repercussa*, but it is less solid and heavy, the *lower* arm of the bifurcation on the parietal wall is *longer* than the upper, and the thin free horizontal fold near the lower suture is not united to the ridge at the aperture and *does not proceed beyond the lower arm of the bifurcation*, as it does in *P. repercussa*. The upper fold of the palatal armature is much shorter than in *P. repercussa*, terminating posteriorly at the same point as the shorter upper arm of the parietal bifurcation; the second and fifth horizontal palatal folds are much shorter anteriorly than in *P. repercussa*; while the vertical palatal plate (the fourth) is broader, but less stout and less inclined towards the aperture than is the case in that species. The specimen shown in figs. 79*d* and *e* is from Moulmain, and is in my collection. It measures: major diameter, 28 millimetres; minor diameter, 22 millimetres; altitude, 7·5 millimetres. Mr. Blanford has also recorded the species from Tenasserim ("British Burma Gazetteer" (1879), i. p. 709), while Mr. Nevill mentions Kuengan ("Hand-list," p. 72). Mr. Ponsonby possesses two specimens from Sgwagakin, Salween Valley, measuring 25 millimetres in diameter. Figs. 79*a–c* are reproduced from photographs of Dr. Gould's type specimens in the New York State Museum. Dr. Bagg has supplied the following notes respecting them: "*Helix anguina*, Gould. Catalogue No., 251; original No., A 558. The shell is somewhat banded by brownish and white alternating, but not in all specimens." Fig. 79*f* shows the posterior aspect of the parietal and palatal armatures.

(*To be continued.*)

ORIGIN OF SPECIES IN INSECTS.

By J. W. Tutt, F.E.S.

(*Continued from p.* 44.)

On the Origin of Species.

A GREAT change in the environment of a species, locally, produces in that district a local race. It matters not whether the change be one of climate, food-supply, introduction of new enemies, or geological change, so long as it is sufficiently marked to affect the species injuriously under the new conditions. Given these conditions, and the injury will result in extermination, unless some structural or functional modification be developed in the species which will enable it to combat the disabilities under which it now lives, and, in time, to succeed under the new conditions. We have already seen that a recent change in the environment of certain Lepidoptera has resulted in the development of a maximum of black scales, so that the colour of the insect may respond to its new environment. We have also seen that this change of colour is simply a change in the proportion of the black scales (always present in the species) developed. The change then must take place by the modification of the different variable factors that play around what we may term the "mean" of any structural part of the insect. It must be evident that from these variable factors alone can utility obtain the materials that it moulds into those lines which will fit the species to its new environment. Survival of the fittest in the required direction or directions goes on year by year, and thus the species is maintained under the new conditions.

Little further insight is needed to see that more than one modification may be necessary, and that under a complex series of change divergent races might be formed, each specially suited for success in different directions; whilst the original type of

the species might become extinct. In this way we obtain the beginnings, as it were, of new species, which may take a vast period of time before they become thoroughly differentiated from each other. The more rapidly and sharply certain peculiarities separate them, especially peculiarities of the genital organs, the more rapidly would their complete separation as species be brought about.

Specialization of Genital Organs.

There appears, however, to be no reason whatever why changes of the genital organs should take place under changing conditions of environment, such as those just suggested, nor why changes in the genital organs should accompany other changes necessary for greater speed, better concealment, or other habit now assumed to be a matter of necessity to the species. It is evident that the safety of insects depends primarily upon colour (protective or warning), speed, nauseous excretions, development of fascicles of hair in place of simple tubercles, waving flagella, osmateria, discharges of acid and gaseous matters and similar factors, rather than on changes, either in structure or function, of the internal organs. All or any of the various changes just enumerated may be effected without the slightest change in the structure of the genital organs, and hence it is possible for new species to be developed with distinct and conspicuous external characters, either in the imaginal, or pupal, or larval, or oval stages, or in all or any of these stages, without any very great modification being necessary in the genital organs. These external characters may be most marked and in every respect specific, as we understand the term. Yet the possibility of successful pairing and the production of fertile ova between the supposed allies may always be present.

Variation in Genital Organs.

That there is usually some well-marked difference presented by the male genital organs of closely allied species is well known. That these same organs, within the limits of a clearly-defined single species, often offer considerable variation, is also well known. That species with very distinct-looking male genitalia, such as those presented by *Anthrocera filipendulae* and *A. trifolii*, will pair and produce hybrid progeny is an ascertained fact. One is uncertain, therefore, how much structural difference is necessary to prevent successful pairing between, and the production of fertile eggs by, two allied species. So little actual experiment in this direction has been performed that one is inclined to reject the statements laid down as veritable axioms, such as one repeatedly finds relating to this point in the works of even our best naturalists.

Sterility not a Specific Distinction.

No one can read Darwin's remarks on "hybridity," in the "Origin of Species," without recognizing that he was not at all clear how far fertility between allied species was general or the reverse. He was, however, evidently quite clear that the ability of two forms to cross and to produce fertile progeny did not render them any the less two quite distinct species. Yet he assumed that between first crosses there was a tendency to sterility, and that in the intercrossing of the hybrids there was a still greater tendency in this direction. In spite of this, cases are cited by him in which hybrid plants were as fertile as the parent species. He also cites the well-known case of *Phasianus colchicus* and *P. torquatus*, and the case of the Indian humped ox being perfectly fertile with the common ox, in each instance the hybrids also being fertile. When one considers the difficulties of breeding animals artificially, the ill effects of in-breeding, the individual idiosyncrasies of each animal, the thousand and one difficulties that have to be surmounted in order only to attain a fair amount of success when breeding the same species, it appears evident that we require much more detailed information before any very sweeping generalizations may be formulated.

Incipient Species and Partial Sterility.

Even Wallace lays it down as a law that, when two incipient species are in process of formation, one condition of their differentiation as distinct species necessitates "some amount of infertility when crossed with the parent form or with each other." Now, it appears to me, once the power is granted for certain species to be able to hybridise freely, somewhat illogical to insist on this as a general principle, and, I must confess that, although I can see the advantage to the incipient forms should such a condition arise, yet I do not at all follow the necessity for it. Wallace supports his view by asserting that the danger of a species, placed under new and adverse conditions, so that it cannot adapt itself to them with sufficient rapidity, is much increased if crossing with the parent form is not checked and afterwards completely prevented except as a very occasional occurrence. He looks upon the means of preventing intercrossing as being three in number: (1) infertility; (2) the presence of "recognition marks" or external distinctions leading to the preferential mating of similar forms; (3) physical isolation. He believes that the latter is of little importance, because the majority of new species must arise in the midst of the population of existing species. He thinks, further, that mutual infertility would be usually brought about by natural selection wherever the two forms were in contact; also that the early occurrence of well-

marked differences would assist greatly in the rapidity of adaptation.

Value of Recognition Marks.

The value of these "recognition marks" is probably of some importance in many species, yet the presence of such marks does not prevent the crossing of such species as *Smerinthus ocellatus* and *S. populi*, of *Amphidasys strataria* and *A. betularia*, of *Ennomos quercinaria* (*angularia*) and *E. autumnaria*, when opportunity offers. Still, there can be no doubt that, in Lepidoptera, specialization of androconial scales, scent tufts, and similar structures may have much to do with the usual natural mating of species, especially in view of our present knowledge of the sight of insects, and the doubt that may naturally arise as to their want of ability to discriminate small and trifling colour marks, such as those which usually exist between two very closely allied species. Nor is the colour sense of insects sufficiently defined to prevent the pairing of a perfectly normal specimen of *A. betularia* with a perfectly melanic aberration of the species, nor the correct pairing of the various forms of a polymorphic species like *Cidaria immanata*. It would appear certain, therefore, that the correct pairing of species in nature among Lepidoptera is often due to causes other than recognition marks, however important a part they may play in certain cases.

Isolation.

Although I do not see that mutual infertility would be, as Wallace asserts, brought about by natural selection wherever two incipient species were in contact, yet it is quite clear that, in some way, nature must prevent their crossing, if a new form, or forms, is to be differentiated. Now, it is quite clear that, to prevent this, isolation of some kind must occur. After a careful consideration of the matter, it appears to me that, among Lepidoptera at least, the isolation is frequently more or less perfectly brought about by a difference in the time of year at which the imago reaches the perfect stage. Among our butterflies the single brood of *Limenitis sibylla* falls between the two broods of the allied *L. camilla*, and, in this case, there is not even a differentiation of the food-plants of the two species, both being confined to honeysuckle. Similarly, the single-brooded *Polyommatus corydon* falls between the two broods of *P. bellargus*, nor must it be thought that these species are so distinct as the colour of their respective males would suggest, for Buckler and Hellins were both unable to definitely distinguish the larvae, whilst I have in my possession an undoubted wild hybrid of these two species. I need only call attention to the single-brooded *Cidaria immanata*, which occurs in July and August, at a time practically intermediate between the two broods of *C. russata;* to the parallel instance of the single-brood of *Tephrosia crepuscularia*, which appears between the two broods of *T. bistortata*. True, the emergences may occasionally overlap for a few days, locally; but for all intents and purposes the species are as perfectly isolated as if their habitats were separated by some of the most marked physical barriers. Isolation, indeed, must be the essential factor of the differentiation of new species, and an isolation that is engendered by the physical inability of two species to appear in the imaginal state at the same time is as potent as any physical barrier that prevents the two incipient species spreading to each other's grounds. It is only isolation of the kind pointed out above that could allow of the formation of a new species under the same general conditions and on the same ground as that occupied by its immediate progenitor. Given this isolation, the close interbreeding of the individuals of the new form and the intensification of its peculiarities are as assured as is the powerlessness of the new to cross with the ancestral form. The formation of peculiar androconia and other characters will also tend to specialize the new form, and when once the peculiarities of the new form, albeit at first modifications of the old form, have become fixed, the possibility of crossing frequently in nature, even if subsequent changes lead to their appearance at the same time, will be much lessened thereby. How strong a factor this may really be in the differentiation of closely allied species will be evident to every field entomologist. *Brenthis euphrosyne* and *B. selene* offer an illustration. In dozens of closely allied Noctuid moths its influence is evident, *e.g.*, *Agrotis tritici* and *A. obelisca*, occurring in July–August and late September respectively. *Caradrina ambigua* and *C. taraxaci*, *Agrotis segetum* and *A. lunigera*, *Triphaena subsequa* and *T. orbona* (*comes*), etc. In none of these are there any real "recognition marks" in the true sense of the word.

(To be continued.)

There is a persistent rumour that Sir William Crooke's presidential address this year at Bristol, to the British Association, is to cause some sensation and be a of startling character.

Structure of Butterflies' Wings.—Mr. A. Radcliffe has made a comparative study of the venation of butterflies' wings. He sums up his results in the "Transactions of the Entomological Society of London," wherein he states that the changes in the veins "take a direction which stands probably in relation to the mode of flight."

Conference of Astronomers.—Last year's Conference at the Yerkes Observatory having proved so successful, it is proposed to make the gathering annual. The "American Association for the Advancement of Science" will be meeting at Boston on August 22nd, the fiftieth anniversary of its foundation, so the conference will be held at Harvard College Observatory, August 18th, 19th and 20th.

PLANTS AND ANIMALS OF DIFFERENT SOILS.

By H. Franklin Parsons, M.D., F.G.S.

(*Continued from page* 42.)

THE silicious rocks, such as sandstone, sand and gravel, tend to form by disintegration a light, dry, powdery soil. The character of the soil, however, varies according to the size of the particles of the bed and the readiness with which it undergoes disintegration. Thus, a gritstone, or a sharp gravel or sand, yields a thin, poor soil; while a loamy sand, such as the Thanet sand, forms a warm and kindly one. A light, dry, sandy soil is favourable to the germination of minute seeds: hence sandy cornfields are frequently full of annual weeds, such as the poppy. Sandy commons are the especial habitat of dwarf annual plants, like the various species of *Trifolium* and of Cruciferae and Caryophyllaceae. A wet sand, on the other hand, such as is met with where a layer of retentive clay beneath holds up the water, tends to form a peaty soil, and many of the same plants grow on it as grow on peat. There are others, however, chiefly of a dwarf growth, which prefer a wet sandy soil to pure peat; examples being *Montia fontana, Peplis portula, Anagallis tenella, Salix repens, Juncus bufonius* and *J. squarrosus*. The contrast between the flora of sandy and of chalky soils is, as a general rule, strongly marked, though there are some plants, such as the mulleins, of which we have three species near Croydon, that love a dry soil, but are not particular whether calcareous or not.

The older and more consolidated sand-hills on the coast are often the habitat of plants of a calcareous type, which presumably find the lime which they require in the fragments of sea-shells mixed with the sand. The plants which make their habitat on the loose sand-dunes are remarkable for possessing long, tough roots, or widely-spreading rhizomes, which fulfil a useful purpose by binding the shifting sands together; the sand sedge *(Carex arenaria)* and marram or star grass *(Psamma arenaria)* being noteworthy examples. Of plants characteristic of a sandy soil, the foxglove, broom, corn marigold, wood sage and small sorrel are familiar examples. The Scotch fir, though probably not a native in the south of England, flourishes and propagates itself freely in such a soil, covering large tracts of the Bagshot sands in western Surrey. The larger ferns, mosses and fungi abound in damp woods on a sandy soil. A loose sandy soil is favourable to the operations of burrowing animals, such as rabbits and moles.

Peat is a deposit of vegetable origin, formed in cold, moist situations, usually on waterlogged sand or silicious rock, less frequently or less perfectly on clay, and very rarely on limestone. It consists almost entirely of the decayed semicarbonized remains of plants, such as the small shrubby Ericaceae, rushes and sedges, and the larger mosses, especially *Sphagnum* and *Polytrichum*. When free from admixture with sand, it contains only a very small proportion of mineral matter, as shown by the trifling amount of ash left when it is burnt in a heath fire. It may attain in bogs a depth of twenty feet or more, though it shrinks greatly in thickness on drying, when the bog is drained. It is, however, not very readily permeable by water. A peaty soil is generally covered by brown heathery moorlands. The vegetation is marked by a comparatively small number of species present, though each species is represented by a profusion of individual plants; also by the rarity of grasses and plants with yellow flowers, and by the almost total absence of pasture plants and of the weeds of cultivation. The birch is the prevalent tree. Among characteristic plants of the peat may be mentioned the sundews, cross-leaved heath, bog asphodel, bog violet, bog myrtle, and the grasses *Molinia caerulea* and *Nardus stricta*.

A clay soil is typically heavy and impervious to moisture. A pure, stiff clay forms naturally a poor, cold, backward soil; but by cultivation, admixture with lighter materials and manuring, such a soil can be greatly improved. Clay is very retentive of organic matter, whereas in a light soil such matter is soon oxydised and disappears. Hence the effects of manuring last longer in a clay soil than in a sandy soil. A clay basis containing a greater or less proportion of fine sandy matter is called a loam, and one containing a proportion of calcareous matter, a marl. The flora of a pure clay is comparatively poor in species, and is marked less by the presence of particular plants characteristic of clay than by the absence of those characteristic of limestone and sand. Most of the plants which one finds on a clay soil are, in fact, common ones. The vegetation consists mainly of bushes and trees, or of strong-growing perennial plants, often with creeping underground rhizomes like the coltsfoot, couch grass and horsetails. The floras found on loam and marl approach respectively those found on sand and limestone. There are, however, a number of plants which prefer a heavy soil, though not confined to a pure clay. A familiar instance is the primrose, which is absent from the sandy and gravelly tracts of West Surrey, but is plentiful, where it has not been exterminated,

on the heavier soils. Other examples are the rest-harrow, the devil's-bit scabious, the sneeze-wort *(Achillea ptarmica)* and the field sow-thistle.

Besides the above principal classes of soils there are others of a mixed character or of special kinds. There is alluvial loam and brick-earth, associations of fine sandy and clayey particles with more or less organic matter, forming a fertile soil, with a flora of a mixed and varied character. There is marsh soil, a rich black unctuous mould consisting largely of decayed vegetable matter, and supporting a flora in which rushes, sedges and coarse grasses predominate. There is the sea sand of which I have already spoken, and the salt marshes, with a flora consisting largely of succulent plants, especially species of Chenopodiaceae. The succulence appears to be related to the amount of salt present in the soil. Some species, such as *Glaux maritima*, *Aster tripolium* and *Plantago maritima*, which are dwarf and succulent when growing in a salt marsh, are rank and weedy in habit when they grow on the banks of a tidal river in its upper reaches, where the water is only slightly brackish.

The different kinds of soil are marked by the abundance of particular sorts of trees. Thus the beech is pre-eminently the tree of chalky soils, though it thrives also on other dry soils, as on the Bagshot beds of the New Forest, the hills of the greensand and the Oldhaven pebble gravels in the neighbourhood of Addington. Among smaller trees and shrubs, the yew, white beam tree, juniper, wayfaring tree and traveller's joy, are chiefly found on calcareous soils. The Scotch fir and other Coniferae thrive best on a sandy soil. The birch also prefers a silicious or peaty soil. Ericaceous shrubs, such as the rhododendron, love a peaty soil and hate lime. The common elm is partial to rich loam; the wych elm, rocky soil. The oak loves a heavy clay soil. The ash is also frequent on clay, but will grow on almost any kind of soil. Apple trees thrive on a clay soil, and it is said that it is only from orchards on a clay soil that good cider can be made.

The relationship between the nature of the soil and the presence or absence of particular forms of animal life is less direct than that between the soil and the plants which grow upon it. Considerations of the nature of the soil often fail to explain the curiously restricted habitats of certain forms of animal life, *e.g.*, of some butterflies. Nevertheless, it is clear that, whatever other conditions may be necessary, the presence of a particular animal in a locality must often depend upon the presence of some plant needful to it for food, shelter, or in some other way. Thus the nightingale, which builds its nest of oak-leaves, is especially abundant on heavy soils, on which the oak is the predominant tree. At the village of Havering-atte-Bower, Essex, which stands on a sandy eminence, it is said that the nightingale is never heard, though abundant in the clay tract around. In Tennyson's "Harold" this circumstance is ascribed to the influence of the prayers of King Edward; but we should nowadays be more disposed to look for its cause in the character of the soil and prevailing vegetation.

Even the distribution of the human species depends largely on the nature of the soil. Thus at the present time the great centres of population in this country are the coalfields where the raw materials of manufactures are to be procured. Excepting London and towns situated on harbours, almost all our large towns are built on or near the outcrop of the coal measures. In prehistoric times, on the contrary, the chief centres of population appear to have been the chalk downs, which were then open tracts, while the lower and heavier lands were covered with forest. On the chalk downs, too, flint was to be had. It stood in the same relation to primitive man as iron to us, and its manufacture was carried on. In mediaeval times, settlements appear to have been most frequent on the lighter and more fertile soils, such as the green sand, oolites, drift sands and gravels. It is on such soils that we find the villages and parish churches closely clustered together; while on clayey tracts, which were formerly woodlands, or barren heaths and mountains, the villages are few and far between, while the ancient parishes are of wide extent. The boundaries of the old parishes are, as a rule, found to cut across, rather than to coincide with, the natural and physical features of the country, with the object of giving to each parish its share of each different sort of land. Thus, in the case of the villages situated at the foot of the chalk escarpment, each parish has commonly its strip of chalk down for sheep pasture, its portion of land suitable for the plough or grazing, and its share of what was the forest beyond. The position of the villages themselves is determined mainly by considerations of water supply. In a clay country it is usual to find the villages situated on patches of overlying drift gravel, where water is to be obtained by wells. All the older portions of London which were formerly country villages and bear old English names, such as Kensington, Islington, Clapham, etc., are thus situated; while places on the London clay were not habitable until a public water service had been provided. In the chalk plateaux of Hampshire and Wiltshire the villages follow each other in close succession along the bottoms of the valleys, where water is to be obtained from streams, springs, or wells. In Northamptonshire, on the other hand, all the villages are on the top of the hills, where a capping of ironsand or limestone rests on the lias clay, and where springs are thrown off at the junction.

Oakhyrst, Park Hill Rise, Croydon.

SIR WILLIAM HENRY FLOWER,

K.C.B., LL.D., Dr.Sc., D.C.L., Ph.D., F.R.S., P.Z.S., Etc.

THE announcement of the retirement of Sir William Flower from the directorship of the British Museum of Natural History, Cromwell Road, South Kensington, is received with universal and unfeigned regret. This severance is the more to be deplored because of its reason, though we are thankful that his health has been spared long enough to enable him to place the Natural History Museum of this country beyond the first rank of such institutions. To wander through its spacious courts and long galleries is needed for appreciation of the organizing faculty which has directed the excellence of general arrangements. It is now, with the exception of a few details, a perfect model of what should be a modern museum of specimens in natural history for scientific teaching. No doubt Sir William has been ably and loyally supported by a clever staff of departmental keepers and assistants. All have willingly striven for success, and it is attained.

Sir William Henry Flower was born at Stratford-on-Avon, the second son of the late Mr. Edward Fordham Flower of that town, on November 30th, 1831. He was educated for the medical profession at University College, London, and the Middlesex Hospital. After qualifying, he joined the 63rd Regiment, as surgeon, in April, 1854, and served in the Crimean War, for which he holds medal, four clasps, and Turkish medal. Returning to London he was appointed Assistant Surgeon to the Middlesex Hospital, holding the post during 1859 to 1861, when he received the appointment of Conservator of the Museum of the Royal College of Surgeons, in Lincoln's Inn Fields. In 1869 he became Hunterian Professor of Comparative Anatomy and Physiology, retaining both offices until appointed Director of the Natural History Departments of the British Museum in 1884, on the retirement of Sir Richard Owen. Sir William was President of the section of Biology at the British Association, Dublin meeting, in 1878, and President of the Association at the Newcastle-on-Tyne meeting in 1889; President of the Anthropological Institute from 1883 to 1885; President of the Section of Anatomy at the International Medical Congress of London in 1881. In 1879 Sir William became President of the Zoological Society of London, and still occupies that position. He received the honour of a Companionship of the Bath in 1887, and was promoted to be a K.C.B. in 1892. He is an honorary LL.D. of Edinburgh and Dublin, D.C.L. of Durham, and D.Sc. of Cambridge. He is a Correspondent of the Institute of France, and he was elected President for the forthcoming International Congress of Zoology to be held at Cambridge this August, but impaired health caused his retirement.

It will always be in association with his admirable museum work, first in Lincoln's Inn Fields and then at South Kensington, that the name of Sir William Henry Flower will be spoken. Still, he has written several important memoirs on zoological and anatomical subjects, and some more extended works, for instance, that on "The Horse, a Study in Natural History"; and in collaboration with Mr. Lydekker, he published in 1891 "An Introduction to the Study of Mammals, Living or Extinct." The last publication of Sir William's collected essays is noticed in this number at page 85. It is embellished with a kindly dedication to Lady Flower, who was Georgiana Rosetta, the youngest daughter of Admiral W. H. Smyth, D.C.L., F.R.S. They were married in 1858. His son, Lieut. Stanley S. Flower, F.Z.S., is numbered as a contributor to these pages, and among our general supporters none is more valued than Sir William himself. Although professionally engaged for nearly forty years on scientific work, no one has been less assertive of such position. His bearing towards the humblest amateurs has always been cordial, and they might always depend for such advice or assistance he could give in their difficulties. Like so many others who have helped to make Natural Science what it is, Sir William began as an amateur, and therefore appreciates the embarrassments of others.

In consequence of a misapprehension that the office of Director of the Natural History Museum was to be abolished, a very influential memorial against such abolition was signed and presented to the Trustees. Fortunately there does not appear to have been any foundation for such rumour, as it has been contradicted by Sir Edward Maunde Thompson, the Chief Librarian at Bloomsbury. Whoever is appointed in the place of Sir William Flower, we hope the Trustees will succeed in selecting a man with powers of organization, administration, and with a general knowledge, rather than a naturalist skilled in any one branch of natural science. Sir William himself has written: "A curator of a museum must be a man of very considerable education, as well as having natural ability, skill, manual dexterity and good taste. He must possess the moral qualifications of punctuality, habits of business, conciliatory manners, and indomitable industry to discharge the small and monotonous duties constituting so large a part of the curator's life."

J. T. C.

BRITISH INFUSORIA.

By E. H. J. Schuster, F.Z.S.

(*Continued from page 40.*)

Part III.—Ciliata Holotricha.

THE class Ciliata comprises those unicellular animals which move by the vibrations of a large number of small hair-like processes or cilia. The most primary type of ciliate infusor is monaxial, bearing at one end a round mouth and at the other end the anus. The whole surface is clothed with rows of cilia of about the same length, which run in a longitudinal direction. Two nuclear bodies are present, the nucleus, meganucleus, or endoplast, and the paranucleus, micronucleus, or endoplastule. Of these the former seems to preside over the nutrition, the latter over the reproduction of the animal. The body is enclosed in a layer of firmer protoplasm known as the pellicle or cuticle; in this trichocysts are often present. These organs are probably evolved for protective purposes. In optical section they appear to be small highly refractive rods. When the animal is stimulated in certain ways they spring out suddenly into long hairs which stand out from the sides of the body. The application of a very dilute solution of acetic acid or slight pressure on the cover-glass produces this effect in such an animal as *Paramaecium aurelia*.

Departures from the primitive form arise in the following ways: (1) by the prolongation of the anterior portion of the body to form a necklike process; (2) by the shifting of the mouth from the anterior end, either through this neck development or from some other cause; (3) by the excessive development of one side of the body causing asymmetry; (4) by differentiations of the primarily homogeneous rows of cilia. This latter is, perhaps, the most important modification, and it is on the character and arrangement of the cilia that all the various systems of classification are based.

Stein divides the Ciliata into four orders, thus: (1) Holotricha, in which the cilia do not differ much in character and are evenly distributed; (2) Heterotricha, which possesses a specially developed adoral band of cilia; (3) Hypotricha, in which all the cilia except the adoral band are confined to the ventral surface; (4) Peritricha, the cilia of which are arranged in rings which encircle the body.

Saville Kent follows Stein in his arrangement of the orders, but changes about his families considerably. O. Bütschli, in volume i. of "Die Classen und Ordnungen des Thierreichs," creates two orders: into one he puts part of the Holotricha, namely, those who have no undulating membrane in the neighbourhood of the mouth and no cilia in the oesophagus: this he calls the Gymnostomata. The other order contains the rest of the Ciliata, and is called the Trichostomata. Although Bütschli's classification is, perhaps, the most natural, Saville Kent's will be adopted here as I have used it in speaking of the Flagellata.

Family Paramaeciidae, defined by Saville Kent thus:—"Animalcules free-swimming, more or less flattened and asymmetrical, ciliate throughout; oval and cuticular cilia alike; dorsal and ventral surfaces distinct; the oral aperture opening on the ventral surface."

Paramaecium aurelia Müller, affords a good type of the order Holotricha. The shape of the body is like that of a slipper, and from this fact the popular name, "slipper animalcule," is derived. It is of large size, and is plainly visible with the naked eye. On the left side, beginning near the anterior end, is a triangular depression, which is called the "peristome groove." From the apex of the triangle leads a narrow tubular canal, the

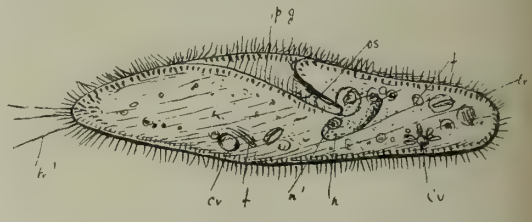


Fig. 20.—*Paramaecium aurelia* (× 200.)
pg, peristome groove; *os*, oesophagus; *tr*, trichocysts undischarged; *tr'*, trichocysts discharged; *cv*, contractile vacuoles; *n*, nucleus; *n'* paranucleus; *f*, food vacuoles.

"oesophagus." At the far end of this is the mouth. The body is covered with a striated cuticle in which trichocysts are evenly distributed. This is clothed with rows of powerful cilia. When the animal is alive, waves of contraction may be seen to pass down these rows. Two contractile vacuoles are present, one in the anterior, the other in the posterior, half of the body. These are not simple, but consist of a central round portion from which spring five or six radial canals. These are said to be connected by a branching system of ring tubules with the whole of the body substance of the animal. The central portion is connected with the exterior by means of a small canal. The vacuole seems to work as follows: water, which probably contains the excreta in solution, gradually collects in the radial canals; these

fill to a certain pitch and then contract, thereby forcing the fluid contained in them into the central portion, which seems to spring into existence when this contraction takes place. It then grows gradually fuller for a time, as the water runs in through the half-contracted radial canals. It then contracts, driving its contents to the exterior, the opening into the radial canals being simultaneously closed up. An inflow of liquid into these canals cause them to fill up suddenly. When they have reached the right degree of fulness they contract, and the process is again repeated. The contractile vacuoles of *Paramaecium* correspond physiologically with the respiratory excretory, and to a certain extent also with the circulatory system of man and the higher animals. Near the centre of the animal a kidney-shaped or oblong nucleus is situated, and by the centre of this the small, round paranucleus.

Reproduction takes place by fission, or by spore formation after encystment. From time to time a process of conjugation appears to be necessary in order that the results of fission may be active and healthy. Two individuals come together and partially fuse. The nuclei are broken up, parts of the paranuclei are interchanged, and new nuclei are formed from the paranuclei. This process is known as "rejuvenescence," and is undoubtedly analogous to sexual reproduction in the higher animals. *Paramaecium aurelia* is exceedingly common and widely distributed; it occurs in stagnant pond and ditch water, and may be generally found in water in which leaves have been macerated.

Paramaecium bursaria Ehrenberg, is much shorter in proportion to its length than *P. aurelia*.

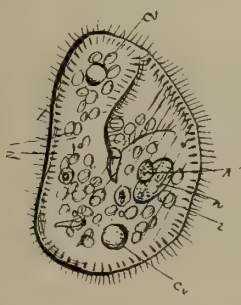


Fig. 21.—*Paramaecium bursaria* (× 200.)
z, zoochlorellen; *cv*, contractile vacuoles; *n*, nucleus; *n'*, paranucleus.

The nucleus and paranucleus are situated in the posterior half of the animal. The arrangement of the mouth, oesophagus and oral groove does not differ much from that of the preceding species. The animal is coloured green owing to the presence of numerous chlorophyllaceous corpuscles Bütschli calls "Zoochlorellen," and which are possibly symbiotic algae. The size of the body varies considerably; 100 microns is, perhaps, the average length.

The animal occurs in marsh water, and is exceedingly common in the Norfolk dykes. The species was first described by Ehrenberg, and referred by him in "Die Infusionsthiere" to the genus *Loxodes;* it was transferred by Foeke in 1836 to the genus in which it now stands.

Family Trachelophyllidae.—"Animalcules free-swimming, ciliate throughout, more or less flask-shaped; oval and cuticular cilia alike; the oral aperture perforating the extremity of the narrower anterior region, which is frequently highly elastic and extensile."

Urotricha lagenula Ehrenberg, is one of the most simply organized of the Ciliata. It is oval in shape, the posterior end is pointed, and bears a long bristle, which forms the chief characteristic of the genus, and from which the generic name (*Urotricha* = hairtail) is derived. It is covered all over, except for a small area at the posterior end, with long cilia. At the anterior end is the mouth,

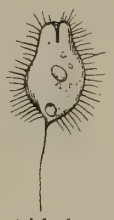


Fig. 22.—*Urotricha lagenula* (× 335.)

which is situated at the end of a narrow oesophagus and is capable of much enlargement. At the posterior end are the anus and a simple contractile vacuole. A spherical nucleus lies in the middle of the body, but as yet no paranucleus has been observed. The surface is coarsely striated; the length of the body is from 20 to 30 microns.

This animal lives in pond and ditch water. It swims slowly, but sometimes makes sudden jumps over a short distance; the jumping movement is due to a sharp vibration of the posterior hair.

Family Colepidae.—"Animalcules free-swimming, symmetrically ovate, persistent in form, ciliate throughout; oval cilia slightly larger than those of the general cuticular surface.

Coleps hirtus Ehrenberg, is barrel-shaped, with one side slightly more convex than the other. The whole body is covered with a hard cuticular exoskeleton, which divides up by grooves running at right angles to one another. One series of grooves is longitudinal, the other is transverse, and in the grooves rows of cilia and trichocysts are placed. At the bottom of a slight depression at the anterior end we find the mouth, and round it a ring of

rather large cilia; at the posterior end is the anus. A spherical nucleus is present in the middle of the body, and one contractile vacuole posterior to it. Zoochlorellen may sometimes be observed.

This species is exceedingly common and widely distributed; it occurs in stagnant water; the

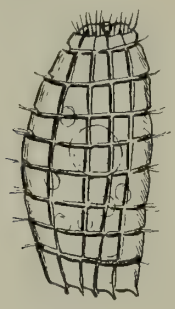


Fig. 23.—*Coleps hirtus* (× 335.)

body length is about 70 microns. The process of transverse fission is as follows: The cuticle becomes separated in the middle, and the body becomes much elongated, the central portion being without corrugations. The centre then becomes constricted and finally cut right through, and two animals are formed, one with corrugated cuticle at its anterior end, the other thus protected at its posterior end. These two animals then proceed to grow gradually into the normal form.

(*To be continued.*)

HELIX NEMORALIS IN IRELAND.

By John T. Carrington.

I AM again indebted to Mr. R. Welch, of Belfast, for a consignment of shells of *Tachea nemoralis* from Co. Down. The former batch was described in Science-Gossip in May last (*vide* vol. iv. N.S. p. 352). These last were kindly gathered by Mrs. Robert Russell, of Belfast, on sand dunes at Killard Point, near Portaferry. Mrs. Russell sent to Mr. Welch 829 specimens, collected "just as they came, without selection," a large proportion being immature. The mature examples were much eroded by sand blowing and weather wear. Mr. Welch retained forty-eight examples for his collection and the Irish collection in the Dublin Museum. These are included in the following analysis of variation occurring in the batch. He chose the forty-eight on account of small size or inclination to have high spiral formation.

The general tendency in size of the Killard Point *T. nemoralis* is to run small, though there are individuals up to the average. Mr. Welch retained some small examples under 18 mm. broad. He suggests it is the result of the past cold spring. This may account for the large number of immatur specimens, but not for the puny adults, which, being much eroded by sand blowing, evidently belong to last year. Sandhill specimens are often smaller than those on better soil. There is some tendency to have high spires, one example being quite the form *conica*.

The colour varieties are three in number, viz., 545 yellow (var. *libellula*), 238 pink (var. *rubella*), 45 orange (var. *aurantia*) = 828 specimens.

The band formulae are as follows:

No bands	..	00000	..	1 specimen.
Split bands, $00_{3}340$ and $123_{4}45$,				2 specimens.
1 band	..	00300	.. 213	,,
2 bands	..	10300	.. 4	,,
2 ,,	..	02300	.. 2	,,
2 ,,	..	00305	.. 6	,,
3 ,,	..	12300	.. 1	,,
3 ,,	..	02340	.. 2	,,
3 ,,	..	02305	.. 1	,,
3 ,,	..	10305	.. 7	,,
3 ,,	..	00345	.. 15	,,
4 ,,	..	12045	.. 3	,,
4 ,,	..	10345	.. 4	,,
4 ,,	..	02345	.. 1	,,
5 ,,	..	12345	.. 319	,,
2 ,,	in 1 ..	0(23)00	.. 1	,,
3 ,,	in 2 ..	1(23)00	.. 1	,,
3 ,,	in 2 ..	0(23)40	.. 1	,,
3 ,,	in 2 ..	003(45)	.. 2	,,
5 ,,	in 1 ..	(12345)	.. 2	,,
5 ,,	in 2 ..	(123)(45)	.. 63	,,
5 ,,	in 3 ..	(12)3(45)	.. 3	,,
5 ,,	in 3 ..	(123)45	.. 85	,,
5 ,,	in 4 ..	1(23)45	.. 21	,,
5 ,,	in 4 ..	(12)345	.. 69	,,

In the colour varieties, yellow largely predominates over the others. Some of the pink specimens are rather dark or richly coloured, but many others showed a tendency to the orange tint. This also appeared slightly in a few of the yellow examples. I think when these animals are bred by artificial selection, it will probably be found that the var. *aurantia* may be often obtained by crossing the pink and yellow forms.

With regard to the band variation, the following points were noted.

The occurrence of only one bandless (00000, *libellula*) among 828 specimens gathered "as they came," is remarkable, and tends to show that the band formulae are hereditary in localities. The absence of bands is the more notable when we find about a fourth of the whole had only one banded 00300.

The proportion of colour in the one-banded form was about equal in average to that of the numbers respectively of the three colour forms represented. Some of these single bands were

strongly marked and wide, whilst two retained by Mr. Welch had "a white fringe to the band" on the lower side. These I have not seen.

In two bands, the form 10300 is scarce; I have only found it previously on Sussex Downs, near Brighton. 02300 is also scarce, and I have taken it twice only in the same Sussex locality. 00305 is likewise scarce, though I have found it in Sussex, North Kent and Lincolnshire.

Of the three-banded forms, the one specimen of 12300 found in the present batch is the only one I have seen, and is believed to be very rare. 10305 is uncommon, as are also 02305 and 02340; but 00345 is by no means so, as it occurs in most localities.

The three four-banded forms are of frequent occurrence, and the five-banded constitutes nearly a third of the whole number. All colours present were about in proportion in the latter band form.

Two bands in one=00(34)0 is rare; I have not before met with it. This Co. Down example is adult, and is distinctly marked. One of the two bands is slightly longer than the other, and where they overlap along the periphery, the colour is darker.

Of three bands in two, 1(23)00 and 0(23)40 are very rare. I had not met with either previously. Unfortunately they and the other variety (12300) were only about two-thirds grown, but I am trying to bring them to maturity in captivity; though from long confinement before they reached me, they are far from vigorous. The other, 003(45) is also new to my experience. I have not seen the example, which is among those retained by Mr. Welch.

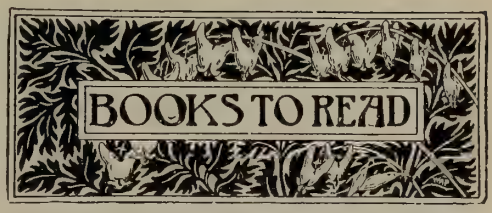
There was only one each, pink and yellow, of the broad-banded five in one (12345), which were rather dark specimens.

As in the last Co. Down lot above referred to, the form common in England (12)3(45) is remarkable for its narrow escape of absence, there being only two specimens in pink and one in yellow.

The form (123)45 is evidently more frequent in Ireland than in England. This I referred to in the May notes as rare here; I would modify that word by saying "infrequent" in England, as I have, since writing, carefully referred to all my older notes.

The two examples of five bands in four are often found in many localities.

I have to thank Mrs. Robert Russell, through Mr. Welch, for kindly giving me the opportunity of examining so large a number of representative specimens. I needed only about a dozen from them for my own collection; so placed the remaining living ones, over 700 in number, to form a colony on the bank of a new road near Wembly Park Station, in Middlesex, where the species did not previously occur.



NOTICES BY JOHN T. CARRINGTON.

NOTE.—*In consequence of the great variety in sizes of books now published, the old descriptions, founded on the folding of the paper on which they are printed, will not in future be followed in these pages. In its stead their size, including binding, will be given in inches, the greater being the length and the lesser the breadth, unless otherwise specified.—Ed.* SCIENCE-GOSSIP.

Essays on Museums, and other Subjects connected with Natural History. By Sir WILLIAM HENRY FLOWER, K.C.B., D.C.L., D.Sc., LL.D., Ph.D., F.R.S., F.R.C.S., P.Z.S., etc. pp. xv.–394, 9¼ in. × 6 in., with illustrations. (London and New York: Macmillan and Co., 1898.) 12s. net.

There is a peculiar interest in taking up this book at the present moment, when its author has voluntarily ceased his active association as its director with the finest natural history museum in the world. Though the fiend of imperfect health has clutched him, it must be a satisfaction to feel that it has fortunately left him time to put in order the magnificent institution at Cromwell Road. The portion of the book before us devoted to consideration of natural history museums is contained in seven contributions to the subject, founded either on addresses or otherwise, which, like the whole of the other chapters, have been edited and collected together. Wherever we dip into its pages we find the influence of its author, ever courteous, kindly, and teeming with information. Best of all, there runs through it a valuable substratum of common-sense, and the faculty of unobtrusively asserting its application. This latter quality above all others has probably accounted for Sir William's great success as an administrator, often under difficult and delicate conditions. The first essay is on Museum Organization, and is founded on a presidential address to the British Association at Newcastle-on-Tyne in 1889. The second is on Modern Museums, a like address at London, in 1893, to the Museums Association. Then follow other essays on Local Museums, School Museums, Boys' Museums, the Booth Museum at Brighton, and on the Museum of the Royal College of Surgeons of England, some time under the author's direction. The rest of the essays, in all two dozen in number, are devoted to general biology, anthropology and biographical sketches. This book is one which should be in every borough library where the Libraries and Museums Act is in force, and the first readers should be the members of the museum committees, the type of men referred to by Sir William, who offer £50 per annum for a curator with *scientific* attainments. Then the death blow to the old system of congregating anything that is curious into a general chaos, will indeed be given; for the system still lingers in places where one would little expect to find such "amuseums." For the general reader most of the essays will be a source of delight as well as instruction. Nowhere do we find the cynic, though everywhere the kindly Professor Flower of old, always ready to assist the young or older naturalists.

The Wonderful Century: Its Successes and Failures. By ALFRED RUSSEL WALLACE. pp. x.-400, 8 in. × 5½ in. With portrait and 12 diagrams. (London: Swan Sonnenschein and Co., Limited. New York: Dodd, Mead and Co., 1898.) 7s. 6d.

The title of this book is perhaps a trifle misleading, for, as explained by the author in his preface, it "is not in any sense a history, even on the most limited scale. It may perhaps be termed an appreciation of the century." One is naturally attracted by such a title and by the author's name as an authority beyond question on subjects scientific; neither is there cause for complaint whilst he deals with the successes of the century in Part I., as they are generally of a scientific nature. It is not every reader who will fully agree with Dr. Russel Wallace in the second part, dealing with other matters and what the author describes as the failures. These, to say the least, are still in the debatable stage of their history, and to definitely call their present position failures is, even for such an authority as Dr. Wallace, using a strong word. The chapters under the heading of "Failures" are a curious mixture of titles, such as the "Neglect of Phrenology," "Opposition to Hypnotism and Psychical Research," "Vaccination a Delusion—its Penal Enforcement a Crime," "Militarism—the Curse of Civilization," "The Demon of Greed," "The Plunder of the Earth," and an appendix on "The Remedy for Want in the Midst of Wealth." One cannot help thinking, when comparing the magnificent list of successes enumerated by the author, that it would have been more satisfactory to most readers if some of the 252 pages devoted to Failures had been added to the 148 pages of Successes. It would have looked less like using an admirable title to induce persons to read Dr. Wallace's views on subjects on which the readers might hold other opinions. We return with more satisfaction to the consideration of Part I. and the Successes. Dr. Wallace treats them popularly and in his old charming literary style; still, more might have been said about the Successes. "Modes of Travelling" is discussed in ten pages. Not that they are not interesting pages, but the trouble is there are only ten of them. The description of this success is too limited. There is no mention of the latest and possibly most important invention in ocean travel, for which the Hon. Charles F. Parsons was made a F.R.S. at the last election: the compound steam turbine that will probably raise the speed of vessels to fifty miles an hour. Electric railways are left severely alone, as are the cheap fares on railways and street tramways. Steep-grade mountain railways are omitted, as are underground and elevated railroads. No word is given to the importance of education by combined travel, known as "conducted tours." "Labour-saving machinery" is dismissed in four pages. We cannot find any reference to the introduction of acetylene gas, already lighting hundreds of houses in this country, and which seems destined to oust other artificial lights. Phrenology is favoured with about thirty-four pages and vaccination with a hundred pages, all but two. We wish Dr. Russel Wallace had written two books instead of the two sections under one cover. The first part would then have better justified the title of the work, and those who wanted the subject matter of the second part need not have had to complain of the space occupied by the first being only 148 pages.

Insects: Foes and Friends. By W. EGMONT KIRBY, M.D. With Preface by W. F. KIRBY, F.L.S., F.E.S. pp. x.–138, 5½ in. × 4 in. With 32 coloured plates. (London: S. W. Partridge and Co., 1898.) 1s. 6d.

This is a bright-looking little picture-book that will be useful as a gift-book for young children. The coloured pictures, which form the leading feature, are sure to be attractive, and the letter-press is concise and correct as a whole.

Illustrated Guide to The Royal Gardens, Kew. Edited by MRS. S. GOLDNEY, 40 pp., 7½ in. tall × 8¾ in. wide. Illustrated from Photographs by WALTER JOHN MILLS. (London: Dawbarn and Ward, Limited, 1898.) 1s. net.

This little book makes a pretty souvenir of the Royal Gardens at Kew. It is essentially a picture-book, and must be considered only as such, as the literary matter accompanying the pictures is curious rather than valuable. Considering how few of the many visitors to the gardens take any interest in botany, we suppose the quality of the literary dish served with the beautifully prepared illustrations matters little. It is a pity, however, that so good an opportunity has been lost. Still the book is worth the shilling asked for it.

Birds of Montreal. By ERNEST D. WINTLE. pp. viii.–281. 8¾ in. × 6 in., with map and 4 illustrations. (Montreal: W. Drysdale and Co. London: John Wheldon and Co.) 5s.

The author has spent some fifteen years of research and observation to produce this annotated list of the birds frequenting the Montreal district of Canada. The island contains scenery suitable for the haunts of bird-life by the side of the St. Lawrence, up which river it is situated 620 miles from the sea. Mr. Wintle, who is an associate member of the "American Ornithologists' Union," includes 254 species in this list. Of course it does not contain any description of the birds, but there are many valuable notes that will be useful in aiding the observation of future ornithologists. At the end of the book, as a sort of supplement, are some original sporting sketches by David Dennie, dated 1895, and an abstract of the fish and game laws of 1896, showing the close times for the district. We note it is unlawful to take the nests or eggs of wild birds at any time of the year, the fines ranging from about 10s. to £20.

An Illustrated Manual of British Birds. By HOWARD SAUNDERS, F.L.S., F.Z.S. Second Edition revised. 8¾ in. × 5¾ in. (London: Gurney and Jackson, 1898.) 1s. per monthly part.

Parts 4 to 8 have been received of this work in addition to those mentioned in the last volume of SCIENCE-GOSSIP (pp. 205 and 265). Among the new illustrations in the parts before us of this second edition are red-throated pipit, Siberian meadow-bunting, short-eared owl (much more natural looking than in the last edition), tawny owl and little owl. Altogether these constitute four bright parts of this useful and trustworthy work, which is to be finished in twenty parts.

Illustrated Guide to Leamington Spa. By BERNARD C. P. WALTERS. 150 pp., 7¼ in. × 5 in. Numerous illustrations by W. T. WHITEHEAD, plan and map. (London: Dawbarn and Ward, Ltd., 1898.) 1s.

The district covered by this pretty guide includes Warwick, Kenilworth and Coventry, as well as Leamington. It is embellished with drawings by Mr. W. T. Whitehead. It will be useful to those visiting the district; but the naturalist will not find much about the plants or animals found there.

Illustrated Guide to Belfast, Giant's Causeway and Antrim Coast. 177 pp., 6½ in. × 4 in., with maps and numerous illustrations. (Belfast: W. and G. Baird, 1898.) 6d.

The North of Ireland railways are energetically placing the many charming features of their district well before the public, which are sure to be attracted to the region for holiday trips. The visitors could find no prettier or historically more interesting district. In this guide, which is the official handbook of the Belfast and Northern Counties Railway, are many illustrations showing the character of the country. Naturalists will find it a happy hunting-ground, and will get from the chapters devoted to botany and geology much useful information. These are written by Mr. R. Lloyd Praeger and Professor Grenville A. J. Cole. Many of the illustrations are by Mr. Robert Welch, and are good, as usual with his work.

Types of Scenery and their Influence on Literature. By Sir Archibald Geikie, D.C.L., F.R.S. (London: Macmillan and Co., Limited, 1898.) 2s. net.

This work of fifty-nine pages constitutes the Romanes Lecture delivered in the Sheldonian Theatre at Oxford on June 1st, 1898. No one who is not a geologist could have traced the important influence upon literature which natural scenery has had in the striking manner in which this is shown in the work before us. The scenery of the island is divided into (1) the Lowlands of Britain; (2) the Uplands of Southern Scotland and the Border Country; and (3) the Highlands of Scotland, Wales and the Lakes. The characteristic lowland topography is seen east of a line drawn across England from the mouth of the Humber, through the Midlands to the Bristol Channel. West of this imaginary line are found the harder and more durable rocks which, owing to the slowness and diversity of their weathering, have given rise to an altogether different style of river and stream scenery, distinct as possible from the quiet, easy-flowing river-bank country through which the rivers of the east and south-east wend their way. The placid scenery of the eastern lowlands has had an important influence upon the poets of nature, such as Cowper, Thompson and Burns; and Sir Archibald shows how each has been influenced similarly by the lowland scenery around them as they wrote, although he acknowledges the differences which necessarily characterised their respective works. Scott and Wordsworth are characteristic upland poets. The surface of the uplands, where not covered with peat-moss, is uninhabited and clothed with bent or heather. It is in the hollows, which lead down into the main valleys, where the farms and villages have been planted. These strips of land, sunk below the general level, have been carved out by the "waters" now leading through them, and these streams, regarded with veneration by those who lived upon their banks, have played an influential part in upland poetry. Classed together as Highlands, for the purposes of the present inquiry, is the higher, more rugged and mountainous ground. Each of the varied kinds of rock has its characteristic weathering, and with a heavier rainfall than in the lowlands the topography is bolder and more diverse. This kind of scenery is depicted in James Macpherson's "Fragments of Ancient Poetry Collected in the Highlands," published in 1760, and in his other works which followed. Into the controversy which arose concerning the so-called "Poems of Ossian" Sir Archibald declines to enter, but prefers to approach them from a scenic and topographical point of view. The author of the poems was twenty-four when his remarkable delineations of highland landscape appeared, and he showed himself to be a true poet of nature. It is pointed out, curiously enough, that three of the poets chosen for notice in this work have held up the geologist to ridicule: Cowper in "The Task" (book iii., 150), Wordsworth in "The Excursion" (book iii.), Scott in "St. Ronan's Well" (chap. ii.) —all make amusing and more or less sarcastic allusions to the stone-chipping, hammer-armed geologists. Like Hugh Miller, Sir Archibald believes there is yet to come some poetic seer who, looking over the whole purview of geology, will place before man's eye "the inner meaning of mountain and glen." The booklet is to be recommended for its literary as well as its scientific importance.—E. A. M.

Lily Tank in Herbaceous Gardens.
From "The Royal Gardens, Kew."

Professor E. B. Frost, of Dartmouth College, has been appointed Professor of Astrophysics at the Yerkes Observatory.

As successor to the late Edward Wilson, Mr. Herbert Bolton, Assistant Keeper at the Manchester Museum, has been appointed Curator of the Bristol Museum.

In the "Journal of Conchology" for July is an admirable article by Mr. Lionel E. Adams, B.A., on the pairing of *Limax maximus* L. It shows acute observation on the part of the author, and it is illustrated by a plate of great interest.

It is stated that a carrier pigeon, belonging to the Rev. J. W. McKenzie, of Whitwick in Leicestershire, has taken a homing flight from the Shetland Isles, a distance of 513 miles from Whitwick, in ten hours and twenty-five minutes, being an average speed of 1,453 yards per minute. This, if authentic, is some guide when considering the flight of birds during migration.

In Britain several animals occur in very restricted localities, which are commonly distributed on the continent of Europe. For instance, Mr. E. A. Newberry draws attention to the discovery of a single specimen each at Lakenheath and at Hendon of the beetle *Harpalus picipennis*, hitherto considered exclusively a coast species in this country. It is by no means so restricted on the Continent, occurring in localities far from the sea. *Helix pomatia*, the large edible snail, is confined to certain chalk hills in Britain, but is common in vineyards on other soils in France, far away from chalk or limestone.

Canon Rawnsley states that the water is now entirely withdrawn from the Fall of Foyers, and that foul smells pervade a considerable area of Loch Ness. All the fir-trees within about 200 yards of the factory are dead. There were people who smiled at the Duke of Westminster's forecast of this in 1895, as an exaggeration. It behoves those who value the scenery of our country to watch some other places in Wales and elsewhere, in view of like events occurring through the present scramble for cheap water-power.

The Annual Index to Periodicals, compiled by Miss E. Hetherington, of the "Review of Reviews" staff, is announced to appear this month. It should be useful to our readers, or their societies' libraries. Its price is ten shillings. The July number of the "Review of Reviews" is an excellent one, and contains a series of engravings of some of the late Edward Burne-Jones' pictures.

The vast importance of one's eyesight is such that we notice with satisfaction the Spectacle Makers' Company, one of the ancient London Guilds, is moving for a qualification in those who retail aids to sight. This is not before the necessity has arisen, knowing we may now buy glasses at any sort of small optician's shop, or at a chemist's, and even in a stationer's. We recently saw a pair sold in one of the latter shops, for sixpence-halfpenny, by a girl of sixteen. Who knows what harm may be done to the purchaser's sight?

Science is beginning to tell with the better education of the prospector for minerals. In the days gone past he was usually a man with much experience, but little scientific knowledge, who was content to deal with the ores of gold, silver, copper and the like. Such men passed the rarer metals with no more than a look of curiosity.

Recently, however, this better education has detected a valuable though small deposit, in a very restricted locality in the Lusitanian corner of Europe, of the scarce metal vanadium, one of the best alloys known for strengthening steel, etc.

At present the pure oxide of vanadium is worth 135 shillings a pound, and the pure metal sells at eight shillings for every twenty grains weight. It has hitherto been chiefly utilized for transforming aniline dyes into an intense black to be used for indelible ink, and also for colouring glass.

Mr. Upcott Gill is shortly to publish a new book on "British Dragonflies," by a specialist, Mr. W. J. Lucas, B.A. It will be beautifully illustrated in colours. Specimen plates and circular may be had on application to Mr. Gill, 170, Strand, W.C.

In a review of Mr. Laver's "Animals of Essex,' in "Nature," of July 14th, it is complained that the author had not followed the nomenclature in the new list of British Animals by Mr. Oldfield Thomas. The reviewer goes on to say: "It may be uncongenial, but the sooner amateur naturalists take to following the lead of their professional brethren the better it will be for all parties. The change is bound to come, and it may as well be accepted gracefully."

In reading these opinions, given with the authority whence they come, no doubt many of our readers will feel a sense of intense satisfaction in learning that the nomenclature of at least one group of British animals has been settled once and for all. Is this the fact, however? We heard in the past the same thing on the production of certain lists in other departments. "This list will finally settle the matter," was said of several important groups of plants and animals, whose nomenclature is now in a worse state of confusion than ever.

That amateur naturalists do not object to the change as indicated in "Nature" is proved by the frequent, one may almost say continual, attempts they are making in following the nomenclature of the respective departments of their study. Take, for instance, an English lepidopterologist of mature years. He will tell us that some of our species have had their names changed, both specific and generic, at least four times in his memory. Neither is there any prospect of the end arriving. The botanists are in equal tribulation.

For the amateur there is some excuse. There is none for the professional naturalists, that is, those who are paid for their work, that they should not by this time have definitely settled the scientific names for at least the limited number of animals and plants occurring in these islands. By doing so, far more good would be done than by the multiplication of "species." The amateur will be ready enough to gracefully and gladly accept any list of names that is final. What he objects to is the constant re-learning of names for some common creatures known by sight to everybody. It is that which disgusts and drives the amateur's interest from his subject of study.

CONDUCTED BY FRANK C. DENNETT.

1898.	Rises.	Sets.	R.A.	Position at Noon. Dec.
	Aug. h.m.	h.m.	h.m.	
Sun	... 10 ... 4.39 a.m.	... 7.31 p.m.	... 9.21	... 15° 30′ N.
	20 ... 4.55	... 7.11	... 9.59	... 12° 22′
	30 ... 5.11	... 6.51	...10.35	... 8° 55′

	Rises.	Souths.	Sets.	Age at Noon.
Aug.	h.m.	h.m.	h.m.	d. h. m.
Moon · 10 ...	10.40 p.m. ...	6.28 a.m. ...	3·3 p.m.	22 16 13
20 ...	8.29 a.m. ...	2.12 p.m. ...	7.41	3 1 25
30 ...	6.7 p.m. ...	11.27 ...	3.35 a.m.	13 1 25

	Souths.	Semi	R.A.	Position at Noon· Dec.
Aug.	h.m.	Diameter.	h.m.	
Mercury... 10 ...	1.46 p.m. ...	3″ 8	... 11.2 ...	4° 5′ N.
20 ...	1.26	... 4″ 5	... 11.21 ...	0° 10′
30 ...	0 36	... 5″ 2	... 11.12 ...	0° 21′
Venus ... 10 ...	2.44 p.m. ...	8″ 4	... 12.0 ...	0° 15′ N.
20 ...	2.45	... 9″ 1	... 12.40 ...	4° 51′ S.
30 ...	2.45	... 9″ 9	... 13.20 ...	9° 47′
Mars ... 20 ...	7.28 a.m. ...	3″ 0	... 5.24 ...	23° 0′ N.
Jupiter ... 20 ...	2.41 p.m. ...	14″ 8	... 12.36 ...	2° 40′ S.
Saturn ... 20 ...	6.20 p.m. ...	7″ 8	... 16.17 ...	19° 38′ S.
Uranus ... 20 ...	5.53 p.m. ...	1″ 9	... 15.50 ...	19° 56′ S.
Neptune... 20 ...	7.41 a.m. ...	1″ 3	... 5.36 ...	22° 2′ N.

MOON'S PHASES.

	h.m.		h.m.
Full ... Aug. 2 ...	4.29 a.m.	*3rd Qr.* ... Aug. 9 ...	6.13 a.m.
New ... ,, 17 ...	10.35 ,,	*1st Qr.* ... ,, 24 ...	8.32 p.m.
Full ... ,, 31 ...	0.51 p.m.		

In apogee August 13th, at 5 a.m., distant 251,900 miles; and in perigee on 29th, at 1 a.m, distant 226,200 miles.

CONJUNCTIONS OF PLANETS WITH THE MOON:

Aug. 11 ...	Mars*† ...	5 p.m. ...	planet	3° 4′ S.
19 ...	Mercury*† ...	2 p.m. ...	,,	1° 14′ N.
21 ...	Jupiter*† ...	5 a.m. ...	,,	6° 51′ N.
21 ...	Venus* ...	8 a.m. ...	,,	5° 3′ N.
25 ...	Saturn*† ...	5 a.m. ...	,,	5° 4′ N.

* Daylight. † Below English horizon.

THE SUN often has spots on his surface, but spotless days are increasing in frequency.

MERCURY is an evening star, reaching its greatest eastern elongation (27° 22′) at 3 a.m. on the 9th, and at 4 p.m. on the same day is at its greatest distance from the sun (aphelion). This is not a very favourable elongation for observing the planet after sunset.

VENUS is an evening star, in conjunction with Jupiter at 6 p.m. on the 19th, Jupiter being 1° 51′ to the north. The planet is best observed in the early afternoon.

MARS has still a very small apparent diameter, and may be observed during the early morning hours away in the north-eastern heavens. Mars is in conjunction with Neptune at 10 p.m. on the 25th, Mars being 1° 13′ north.

JUPITER is an evening star, setting about two hours after the sun at the beginning of the month, but less than an hour after at the end.

SATURN and URANUS are not well placed, owing to their great south declination. The outside minor axis of Saturn's outer ring still exceeds the angular diameter of the planet, so that he is a really beautiful object when the air will permit observation. Saturn sets near midnight on the 1st, and near 10 p.m. at the end of the month.

NEPTUNE is still too near the sun for successful observation.

METEORS should be specially looked for during August, the principal dates being the 3rd, 5th, 7th to 13th, 15th, and 19th to 22nd.

COMETS.—The month of June has proved itself to be a notable one in the history of cometary astronomy, no less than five of these bodies being discovered within eight days, two of them expected visitors, and the other three strangers. We give particulars of them in order:—

c 1898, discovered June 11th photographically at Lick Observatory by Mr. Coddington, and independently discovered at Bucharest. It, however, rapidly passed too far south to be observed from England. Herr Berberich calculates that it will pass its perihelion on September 15th, at a distance of 1·69. Earth's distance = 1·0

d 1898, Encke's, observed June 12th by Mr. Tebbutt, of Windsor, N.S.W. This too can only be seen in the southern hemisphere.

e 1898, discovered by Mr. Perrine, of Lick Observatory, on June 14th, R.A. 3h. 29m., N. Dec. 58° 36′. According to Herr Berberich it will reach its perihelion on August 5th, at a distance of 0·28, earth's distance = 1·0. It is rapidly brightening, and before this is published it may be expected to be quite six times as bright as when discovered. Its motion is towards south-east. Mr. A. C. D. Crommelin, of the Royal Observatory, writes that on August 1st, at 11 p.m., the comet's place is R.A. 7h. 20m. 8s., N. Dec. 27° 50′; and on August 10th, R.A. 7h. 52m. 47s., N. Dec. 17° 2′, its brightness being 8·5 as great as when discovered.

f 1898, Wolf's, observed by Mr. Hussey, of Lick Observatory, on June 16th, is very faint. Herr Thraen calculates that it passed its perehelion on July 4th. Only observable with large telescopes.

g 1898, discovered by M. Giacobini at Nice on June 18th, in the constellation Capricornus, moving towards the south-west. Prof. Kreutz, of Kiel, calculates that perihelion was passed on July 6th, its least distance from the sun being 1·59, earth's distance representing unity. Dr. Hartwig, on June 21st, described it as "round, about 2′ in diameter, about equal in brightness to a star of the tenth magnitude, and having eccentric condensation." Its brightness is decreasing.

JUPITER'S SATELLITE I. is said to be distinctly elliptical, and measures have recently been published as below.

Date.	Ellipticity.	Rotation Period. h.m.	Observer.	Telescope.
Dec., 1892 ...	100—110 ...	13.3 ...	W. H. Pickering...	13-inch
Oct., 1894 ...	108—120 ...	13.3 ...	,, ...	18 ,,
Mar., 1895 ...	104—120 ...	? ...	A. E. Douglass ...	18 ,,
,, 1897 ...	115—130 ...	12.25 8 ...	,, ...	24 ,,

THE YERKES TELESCOPE.—The first published work of the 40-inch refractor appears in No. 436 of "The Astronomical Journal." It is the results of a fine series of measures of the satellite of Neptune, by Professor E. B. Barnard. One of its eyepieces gives a power of 3,750 diameters.

THE BRITISH ASTRONOMICAL ASSOCIATION holds its next meeting on the last Wednesday in October.

CONDUCTED BY J. H. COOKE, F.L.S., F.G.S.

To whom Notes, Articles and material relating to Microscopy, and intended for SCIENCE-GOSSIP, *are, in the first instance, to be sent, addressed "J. H. Cooke, Edlestone, Battenhall Road, Worcester."*

"THE AMERICAN MONTHLY MICROSCOPICAL JOURNAL."—The current issue contains, among other matter, articles on "Making Transparent Lantern Slides from Marine Specimens," "Microscopic Inspection of Pork for Export" and "Bacterial Diseases transmitted through Oysters."

BACTERIA ON BRONZE IMPLEMENT. — Professor Nicholson found recently at Lewes a bronze implement which had on its surface certain small excrescences. On examination he found that each of these formed a centre of oxidation of recent appearance. He scraped off and examined the material under a quarter and one-seventh inch objective, discovering that the oxidation was due to bacteria which swarmed in it. He asks for similar observations and a method of sterilization.

PRESERVING ALGAE. — To preserve without shrinking use Flemming's weaker solution to kill and fix the specimen (10 c.c. of one per cent. osmic acid, 10 c.c. of one per cent. acetic acid, 25 c.c. of one per cent. chromic acid, and 55 c.c. of distilled water). Its use for from half-an-hour to twenty-four hours will not injure delicate tissues. Add 10 per cent. of glycerine, allowing each drop to diffuse before adding more. This will prevent the shrinking caused by diffusion currents if glycerine is added too quickly. Add the glycerine till the specimen is well covered, when the fixing solution has evaporated from a watch glass in which they are exposed for the purpose. Red algae retain their colour almost perfectly, but green algae lose more or less colour, although the chromotaphores retain their shape perfectly and the cells become clearer than in fresh material.

ACETYLENE IN MICROSCOPY.—We have for some weeks past been experimenting with acetylene as an illuminant in microscopy and have found it to be an unqualified success. The light is so piercing and intense that even after being modified by the coloured glasses it reveals structures that are invisible by the naked oil flame. Some timely investigations in connection with this gas have recently been made by Professor Lewis. The phosphoretted hydrogen existing in the gas from commercial calcium carbide ranges in proportion from ·6 to 2·00 per cent., but as experiment shows that a percentage of 80·00 is necessary to form a mixture liable to spontaneous ignition, there can be absolutely no danger from this impurity. In one of the three types of generator now used, the temperature rose above 800° C. in thirteen minutes. At this high temperature benzine and tarry matters are produced, reducing the volume of liberated gas, and the type of generator is therefore recommended in which the carbide is allowed to fall at intervals upon a perforated tray submerged in a large volume of water.

REPRODUCTION OF THE ROTIFERA.—The current issue of "Natural Science" contains an interesting article by Mr. W. T. Calman on "The Progress of Research on the Reproduction of the Rotifera," in the course of which the various theories as to what are the determining factors in evolution of sex are reviewed.

MUCILAGE FOR LABELS.—Gum arabic, 15·0 parts, tragacanth (pulverized), 7·5, glycerine, 45·0, thymol, 0·3, alcohol, 3·75, water up to 120·0. Dissolve the gum arabic in 15 parts water, and the tragacanth rubbed up with 30 parts water. Mix the two fluids and strain. Next add the glycerine, and finally the thymol dissolved in alcohol.

DOUBLE COLOUR ILLUMINATION.—It is possible, with substage condenser and iris diaphragm, to so light a diatom as to reveal the primary structure in one colour and the secondary in another. Heretofore workers have used cones of light greatly exceeding the aperture of the objective, or else cones very much smaller than the aperture of the objective. The former was on the dark ground principle, the latter involved diffraction. The "Microscopical Journal" now informs us that Mr. Rheinberg has found a plan for getting rid largely of diffraction colour effects, and for using any cone of illumination desired. Just as in low-power colour illumination on the dark ground principle, he places in the substage condenser one of the ordinary double-colour discs having a central spot of one colour surrounded by a ring of a strongly contrasted or complementary colour. He prefers a red centre and a green periphery. By means of the iris diaphragm, the relative proportions of the two colours are so regulated that in looking through the lenses the light appears to be of a neutral tint. This arrangement is suitable for use with high-power objectives.

MICROBES OF LONDON'S WATER.—In Sir E. Frankland's annual report on London's water, just published by the Local Government Board, some very curious details may be found regarding the extreme variability of the filtered product which is supplied to water consumers in the metropolis. Take for example the West Middlesex, which month after month supplies its customers with water of a high degree of purity, containing on one occasion only four microbes per cubic centimetre, and on another appearing to be absolutely sterile. Of what advantage, however, is this, if on another occasion the number amounts up to 120, and on still another to 576 microbes per cubic centimetre? Something happened in the month of June to nearly all of the filters of the five companies drawing from the Thames; all except the Southwark were smitten with a microbial epidemic in June, and even the Southwark had got it on the 2nd of the following month. Of the two companies drawing from the Lea, the New River alone escaped. So serious was the condition that, from the tables given to show the reduction of micro-organisms by filtration alone, we find that in one case 66·3 per cent. of the microbes passed the filters. From all of this Sir E. Frankland points a moral, and draws the attention of the companies to the enormous advantage of fine sand in securing efficient filtration. Some companies go to the trouble of using much finer sand than others, with apparently good results. Thus 1·8 feet of the fine sand of the New River Company and 2·75 feet of that of the West Middlesex are respectively more than twice as efficient as 4 feet of the coarser material used by the Chelsea Company.

MOUNTING UNCINULAS.—The quickest and best way to mount these beautiful fungi, says Mr. L. A. Wilson, of Cleveland, is to preserve them unstained in glycerine jelly. They show best when temporarily examined in a drop of water, but jelly is the next best thing. Few prettier specimens can be found for a cabinet. Though generally unknown and unseen, it is almost impossible to pass through the woods without trampling them under foot. They are found on the leaves of grape, Virginia creepers, maple and elm.

PRESERVING MEDIA.—For diatoms: potassium, mecuric iodide, glycerine. Dissolve the salt in concentrated anhydrous glycerine. The refraction index of this medium is 1·78 to 1·80. For preparing mosses for the herbarium use lactophenol gum: a strong solution of gum arabic in water (1), glucose (2) and lactophenol. For desmids: lactophenol copper solution. Crystallized copper chloride, 0·2 parts; crystallized acetate of copper, 0·2 parts; distilled water, 95·0 parts; lactophenol, 5·0 parts. This preserves the chlorophyll. For fungi, mosses and algae: carbolic acid, 20 parts; lactic acid, 20 parts; glycerine, 40 parts; distilled water, 20 parts.

ANIMAL LIFE CYCLES.—Now that the ponds and lakes teem with aquatic life, our young microscopists should lose no opportunity of making themselves acquainted with the life cycles of the minute organisms they contain. To what end? Because they afford material for the study of those processes in the multiplication of small aquatic organisms which is so essential a condition for the renewal and reinvigoration of higher forms of life. For example, the Infusoria, which are bred in the muddy sediment of ponds and streams, furnish food for the Crustacea, which in their turn are devoured by fishes. Considering that in places far removed from the sea, as is the case, for instance, in some parts of Germany, freshwater fish are held in great esteem by the people, we may construct a chain of living beings, starting with the tiny protozoon of the mud, and passing on from water-fleas to fishes, and finally to man, in which each depends for its existence largely on the individual next below it in the scale. The study affords food for thought.

CURRENT LITERATURE.—The current issue of "The Journal of the Royal Microscopical Society" contains an illustrated article, by Mr. F. W. Millett, on "The Recent Foraminifera of the Malay Archipelago." Dr. T. Chartres White continues "A Few Notes on Micro-Crystallography," in the course of which he details his experiences in crystal making with hippuric acid, hydroquinone, picric acid and an aqueous solution of bichromate of potassium crystallized in a tolerably thick emulsion of gum arabic. Mr. H. G. Madin has been experimenting with the object of finding some cement having the same index of refraction as Iceland-spar for the ordinary ray (viz., 1·66) and therefore suitable for use in certain forms of polarizing prisms made of that material. He has not yet obtained an entirely satisfactory material, but publishes the results of his efforts in the hopes that others will take up the subject. M. Jules Richards has been studying the freshwater fauna of the Canary Islands. His list embraces examples of the Phyllopoda, Cladocera, Copepoda, Ostracoda, Polyzoa and Rotifera. As the islands are volcanic, the freshwater animals must have been borne thither by winds and birds.

A KILLING LIQUID FOR NEMATODES. — The following solution will be found effective: corrosive sublimate, alcohol seventy per cent, and a few drops of acetic acid heated to fifty degrees C.

MULTIPLICATION OF BACTERIA.—At a lecture recently delivered at Mason College, Birmingham, Professor Percy Frankland gave some tables illustrating the extraordinary powers of reproduction possessed by bacteria. From these it was shown that this increase took place from one in 0 hours to 280,000,000,000,000 in forty-eight hours. The form and appearance of these minute living organisms were such that they could only be ascertained with the aid of the most powerful microscopes. Viewed in their isolated condition these bacteria looked harmless and insignificant enough, but they presented a far more menacing appearance when seen engaged in their nefarious work, attacking in their millions the vital tissues of their victims, in which they elaborated those poisons which caused disease and death.

ALFRED ALLEN.—The death of the late Mr. Alfred Allen, of Bath, on the 24th March last, after a painful illness, has removed from an extensive circle of microscopists one who for more than twenty-five years did excellent work, especially in the microscopical field. He was one of the founders of the Postal Micro-cabinet Club through corresponding with Mr. A. Atkinson, of Brigg, who had inserted a letter in SCIENCE-GOSSIP, 1873, calling the attention of its readers to the desirability of forming such an association for microscopists, especially those who resided away from the various towns, and who would like an opportunity to be drawn more closely together. By the enterprise of Mr. Allen, the club was formed that year, and within six years more than 100 members had been enrolled. Its name was then changed to the Postal Microscopical Society. Mr. Allen removed from Essex to Bath, and devoted his leisure time to the interests of the Society; and until his death his self-denying labours maintained it in a very useful career. In 1882, as Secretary, he added to the utility of its work by publishing at monthly and quarterly intervals the journal which not only contained the records of the Society, but some very valuable scientific papers. This journal, although not financially remunerative, was to him a labour of love, and only on the failure of his health in 1897 was he obliged to relinquish his editorial duties. After fifteen years of literary effort, the last volume of "The International Journal of Microscopy and Natural Science" was issued. Mr. Allen was for many years a member of the Bath Microscopical Society, which has now ceased to exist. He filled the office of President, and contributed many valuable papers on entomological researches. We are glad to know that the friends of the late Mr. Allen are hopeful that someone connected with the Postal Microscopical Society is willing to become its Secretary and to carry on the very useful work which the late Secretary so ably prosecuted.—*Richard H. Moore, Bath; July 18th*, 1898.

[The Editor of SCIENCE-GOSSIP offers the hospitality of its columns to the members of the Postal Microscopical Society, and Mr. Cooke, who conducts the Section of Microscopy, will welcome contributions from its members. There appears to be no reason why the office of this journal should not become the headquarters of that Society. *Ed.* SCIENCE-GOSSIP.]

Abnormal Geum.—I send you a specimen of water avens *(Geum rivale* Lin.) gathered near Bellerby, Yorkshire. You will see that a comparatively perfect flower grows from the middle of a monstrous flower and takes the place of the carpels. —*Frank Sich, junr., Niton, Isle of Wight.*

Pink Flowers of Bugle.—With regard to the colour of the flowers of the common bugle (*ante* p. 60), the "Student's Flora" describes it as blue, rarely white or rosy, and "Babington's Manual" also says, "fl. blue, rarely white." The pink-flowered form I have seen near Woodside and in woods near Addington, both localities being in Surrey. At the Addington locality, this colour-variation has come under my notice in different years. During the past spring I encountered the pink-flowered bugle in one of the home counties, but not having made any note at the time, am now uncertain of the locality. The white-flowered form is a very beautiful plant, and this I have gathered in woods near Addington and have also seen the same from Kent.—*C. E. Britton*, 189, *Beresford Street, Camberwell, S.E.*

With reference to Mr. Falconer's note (*ante* p. 60) as to *Ajuga reptans* with pink flowers, I enclose one of several plants which I found on the 19th June on the chalk hills above Luddesdown, Kent, with perfectly white flowers. This *Ajuga* was growing on a chalk plateau such as that described by your correspondent, Dr. Parsons *(ante* p. 41), where the chalk appeared to be covered with a "thin loamy surface soil." I remarked that in the same locality *Polygala vulgaris* was pink in colour, whereas on the harder upper chalk above Wrotham it was invariably a bright blue.—*M. J. Teesdale, St. Margaret's, Thurlow Park Road, Dulwich.*

I have found pink flowers of bugle near Guildford, and also albinos of the same in Herefordshire.—*E. Armatage, Ross, Herefordshire.*

I found *Ajuga reptans* with pink flowers at Cranbrook, Kent, in 1881. At Littlehampton I have gathered a very pale pink variety of *Cnicus lanceolatus*. White varieties of many red flowers are comparatively common, but as far as my experience goes white varieties of flowers normally yellow are rare. The only example I ever found was a single plant of *Crepis foetida*, which had white blossoms just tinged with pink. At Muswell Hill last year there was a plant of *Leontodon autumnalis* with very pale lemon-yellow flowers, and I have noticed specimens of *Anthyllis vulneraria* at Ilfracombe and Tenby with unusually light yellow blossoms, but these were not white.—*J. E. Cooper*, 68, *North Hill, Highgate.*

Flight of Swift.—It often appears to me as if the swift in flying moves its wings alternately, instead of simultaneously, like other birds; but the motion is so exceedingly rapid that it is almost impossible to tell. Can any of your readers say whether this is so and has ever been noticed? If it is the case, surely it must be known and have been remarked upon before; but I have never seen or heard of such a fact. Can anyone account for the extreme paucity of swallows and martins last summer and again this summer? There are hardly any to be seen in this district.—*A. E. Burr, Bath.*

Localities for Tulip and Maidenhair Trees.—In reply to Mr. Martin's enquiry *(ante* p. 21), I can say that two good specimens of *Liriodendron tulipifera* (tulip-tree) are to be found in a nursery at Shamley Green, near Guildford, Surrey. The trees are quite close to the road and can easily be seen from it.—*Harold S. Geikie*, 11, *Aden Terrace, Green Lanes, N.*

There are, I find, four tulip-trees in the Royal Victoria Park, Bath, two of which are in the Botanical Gardens, in which also is a small maidenhair tree. There is a large one in a garden near Bath. It may also interest him to know that there are four specimens of another rare tree, the Judas-tree, in Bath, one in the Botanical and one in the Sydney Gardens, one in a private garden in Bathwick Hill, and one, a very old one, in Holloway, overhanging the foot-pavement.—*A. E. Burr, Bath.*

Both the tulip-tree and maidenhair tree grow at Brockhill, Broad Clyst, Exeter on the property of Mr. W. T. Bagne. Good specimens of both are at Sans Souci, a place at Lychett Minster, Dorset. A tulip-tree is also at Blount's Court, Oxon, belonging to Sir F. Knollys. At Brockhill many curious trees exist, the owner being particularly fond of trees, and of planting rare sorts. The liquid amber tree, a very curious and rare tree, grows in the garden of Col. Balkeley at Hare Hatch, near Twyford, Berks.—*(Mrs.) Emily J. Climenson, Chugra House, West Cliff Road, Bournemouth.*

I saw a maidenhair tree a few years since in the garden of Mrs. Brightden, Stanmore, Middlesex.—*J. W. Walker, Cefn Llys, Stanley Road, Watford.*

There are two tulip-trees growing in this town. One is in Horsham Park, the seat of Mr. R. H. Hurst, J.P.; the other is in the garden of Holly House, North Parade.—*Chas. J. Marten, Hon. Sec. Horsham Museum*, 30, *London Road, Horsham, Sussex.*

I have two fine specimens of tulip-tree here. They were planted at the beginning of the century; the largest has a girth of ten feet.—*J. C. Mansel-Playdell, Whatcombe, Blandford.*

We have specimens of both trees growing in our garden here. The tulip-tree is about thirty feet high, and the maidenhair tree, which is about eleven feet high, is just bursting into leaf.—*Cecil J. T. Birts, Westwood House, Welling, Kent.*

Some few years ago I went to St. Osyth's Priory, where I saw a fine tulip-tree. There is another in front of a chapel in St. John's Road, Tunbridge Wells. I have a very small fern-tree in my garden.—*S. Hatchard, St. Helena, The Common, Tunbridge Wells.*

There is a magnificent specimen of maidenhair tree, *Gingko biloba*, at Whitfield Court, Herefordshire, which was planted by Lady Elizabeth Stanhope about 1775, and is therefore one of the earliest introduced to this country. There are fine tulip-trees at Coughton and Wilton, near Ross, and several gardens in the county have smaller specimens of each species.—*E. Armitage, Ross, Herefordshire.*

Aquaria in Hot Climates.—I have read in Science-Gossip of fish having been kept for a long time in a 10-inch bell aquarium, so that the water need not be changed, and with very little attention. Being myself unsuccessful, with your permission I would ask any of your readers who have succeeded if they will kindly supply me with the result of their

experience. My glass stands outside on a window-sill, which is shaded by a verandah. The thermometer in summer frequently registers above 100° Fahr. in the shade, but the winters are very mild. A plant of *Valisneria*, kept for microscopic purposes, is growing vigorously; but in about ten days after the two small fish have been added, the water becomes green and clouded, and the fish soon die. The choice of aquatic plants in this colony, where the summer is long and dry, is limited. Where the ponds are not kept full by artificial means they soon become dry; and such plants as are to be found are coarse and unsuitable for a small aquarium. In the few ornamental pools that are accessible *Chara* can be obtained, and one or two other plants with small leaves, the names of which I am unable to give.—*Will. Lathlean, St. Peter's, South Australia.*

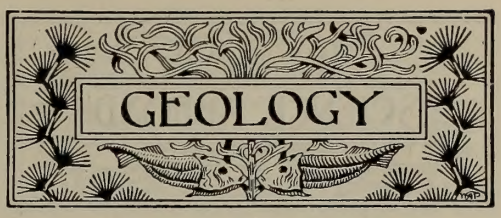
Albinism in Flowers.—Among other cases of albinism which have come under my notice are: *Ballota nigra, Calluna vulgaris, Centaurea scabiosa, Centranthus ruber, Carduus acaulis, C. arvensis, C. palustris, Campanula rotundifolia, Dianthus deltoides, D. plumarius, Epilobium angustifolium, E. montanum, E. hirsutum, Erica tetralix, E. vagans, Erythraea centaurium, Fritiliaria meleagris, Gentiana campestris, Geranium pusillum, G. robertianum, Jasione montana, Lamium purpureum, Lathyrus latifolius, Linaria cymbalaria, Malva moschata, Orchis mascula, O. morio, O. maculata, Ophrys apifera, Origanum vulgare, Prunella vulgaris* (pink), *Primula vulgaris, Pedicularis sylvatica, P. palustris, Papaver rhaeas, Salvia verbenaca, Scilla nutans, Scabiosa succisa, Trifolium pratense, Thymus serpyllum, Veronica agrestis*, and *Vicia sativa.*—*E. Armitage, Ross, Herefordshire.*

White Skylark in Ireland.—A white skylark was shot in this district on December 27th, 1897. There were only one or two grey feathers upon the bird.—*John H. Barbour, Bangor, co. Down.*

The Cheese-ripening Bacteria.—The production of any desired variety of cheese by the introduction of the appropriate microbes is gradually becoming understood. The microbes flavouring the various cheeses have been isolated and cultivated by Dr. Olav Johan Olsen, of Norway, and by adding these cultures to cheese in a storeroom carefully guarded against foreign microbes, he has been able to produce the varieties from which he started. There are but few kinds of the microbes, but they may be combined in different proportions. The art has been sufficiently developed to be carried on commercially.—*J. H. Cooke.*

Double Flowers of Cardamine pratensis.—A friend of mine, the Rev. W. S. H. Samler, remembers seeing, when a boy, a field full of *Cardamine pratensis* in the water meadow at Swallow Cliff, Wilts, in which double flowers were as numerous as single; and last season, while in Devonshire, fishing, he saw at Hemyock, near Tiverton, a similar instance of double-flowered specimens in the same plant. The double flowers were numerous over the field. He gathered some of them and showed me in a dried state. As instances of wild plants producing double flowers are rare and usually solitary, this wholesale occurrence of them is well worthy of investigation, as also the tendency to produce them in that particular plant, of which a third instance was found by another gentleman this season in Yorkshire, near Darlington.—*A. E. Burr, Bath.*

[The same form is frequent by the side of burns running into Loch Ericht on its north side. I have seen many double flowers of *Cardamine pratensis* in that district.—*John T. Carrington.*]



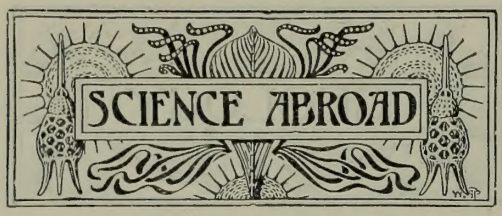
CONDUCTED BY EDWARD A. MARTIN, F.G.S.

To whom all Notes, Articles and material relating to Geology, and intended for Science-Gossip, *are, in the first instance, to be addressed at 69, Bensham Manor Road, Thornton Heath.*

Croydon Water.—The long-protracted drought of the last nine months is having an unexpected effect upon the water supply of Croydon. This is partly drawn from the springs in Surrey Street, and partly from the chalk of the Addington Hills. Owing to the deficient rainfall, it has been deemed advisable to turn off the water between 10.30 p.m. and 5 a.m. The works which were carried on at Waddon by Messrs. Isler and Co. found water at 42·8 feet from the surface, with a supply of ten to twenty million gallons per hour, but are in abeyance owing to local opposition. The bore-hole was situated near a farm at Coldharbour Lane, north of Waddon Station. Grey chalk was bored into at 227 feet.

Geology of Eastbourne.—Having spent Whitsuntide at Eastbourne, a few notes on the locality may be useful to others, as I worked the different formations. The chalk, which is the first to claim our attention, forms the bold cliffs of Beachy Head. There are not many fossils to be seen, though they are more plentiful in the Lower Beds, where I found *Inoceramus concentricus, Polyblastidium racemosum, Plocoscyphia meandrina, Holaster subglobosus, Glyphocyphosoma, Rhynchonella mantelliana.* From the Upper Beds came *Terebratula carnea, Ventriculites radiatus.* The Upper Greensand dips down near the Wish Tower, with the Gault underneath, and rises again near Beachy Head. Fossils found are *Rhynchonella latissima, Terebratula ovata, Ammonites auritus, Hemiaster, Pleurotomaria, Plocoscyphia fenestriata, P. reticulata, Cucullaea cyprinia.* The Wealden is exposed inland at Berwick and Polegate, where it is chiefly Weald Clay, the characteristic fossils being *Cyrena media* and *Paludina elongata.*—*G. Fletcher Brown, 3, Topsfield Parade, Crouch End, N.*

South African Geology.—In vol. liv. part 1, of the "Quarterly Journal of the Geological Society" there is an important paper by Dr. F. H. Hatch on the "Geology of the Southern Transvaal," accompanied by a geological map of the district. The outcrops of the various formations north of the Vaal River are shown; to which the following designations are given. *Karoo System:* (i.) Transvaal Coal-measures (sandstones, grits, shales, fire-clay, and coal-seams). *Cape System:* (i.) Magaliesberg and Gatstrand Series (quartzites, flagstones and shales with igneous sheets); (ii.) Dolomite and Chert Series; (iii.) Black Reef Formation (quartzite and conglomerate); (iv.) Banket Formation or Witwatersrand Series; (v.) Hospital Hill Series. *Archaean System* (igneous complex of granite rocks). The outcrop of the auriferous conglomerate (Banket) beds distinctly shown on the map, and the paper is likely to prove of great use to prospectors and others whose pursuit is not entirely that of geological study.



CONTRIBUTED BY FLORA WINSTONE.

Cosmos (Paris, June 18th). This number contains the first of an interesting series of articles on the "Arms of Ancient Egypt," by M. E. Prisse d'Avennes. The weapons are described in the order of the dynasties under which they were used, and three illustrations are given, two of Seti I., nineteenth dynasty, and one of the chariot and standard of Rameses II. Dr. "L. M." writes on the treatment of fevers, comparing the present methods with those recommended by Hippocrates and others of an early date. An unsigned article, entitled "Le Lux," gives a description, with illustration, of a new generator for acetylene gas, lately invented by M. A. Bayan de Payeux. It does not appear to differ materially in its essentials from those already in use. Dr. Alexander Brian contributes a description of the traces of ancient glaciers of the Pliocene epoch recently found in the Apennines by MM. Sacco and De Stefani. There are four illustrations showing the formation. M. A. Duponchel has the second of a series of notes on his new theory on cosmogony, the subject in this part being the laws of the equilibrium of pressure and of the forces in the sphere of aggregation. (July 2nd.) M. Paul Combes gives a careful description of the progress of working the transcontinental telegraph in Africa. He illustrates his article with a map, showing how much is finished and what is in course of construction. Some notes on music, from the point of view of a physiologist, by M. Laverune, contains interesting accounts of the beneficial effects of music in illness, more especially in cases resulting from derangement of the nervous system. An unsigned article gives an account of a curious shower of "sulphur" which fell at Caumont, in France, on May 2nd. Microscopical and chemical analysis were made of the so-called sulphur by M. Signier, of the Botanical Institute, and by Dr. Louise. The result of their investigations was that the substance was found to be pollen. The shower can be accounted for by the shape of the pollen, being peculiarly suitable for floating in the air. The shower of the 2nd of May followed a violent tempest in the South, but on the 1st of May the air was dry and warm with a moderate wind. M. T. Vazeux writes on the coins of Laodicea, illustrated with various specimens of the money in use at various times among the Phœnicians.

La Nature (Paris, June 18th). The terrible disaster that recently occurred to the steamship "La Bourgogne" lends a peculiar interest to the commencement of the first article in this number of "La Nature." It was from this vessel some successful experiments were made with carrier pigeons to convey messages from vessels in distress. They were conducted by Captain Raynaud. Commandant G. writes on Cuba—especially Havana—giving two maps in illustration. M. E. A. Martel gives an account of the Harbours of Trayas, with three photographs. They are of almost as much interest geologically as artistically; their formation being curious and their origin uncertain, though it was probably due to erosion or some other mechanical action. M. Henri Coupin describes the researches made by MM. Constantin and Matruchot among the mushroom family, with the object of finding some further species that would be edible. The result is that they declare *Tricholomenu* to be harmless and suitable for food. This species is known in certain regions, especially at Poictiers, as "little blue foot" ("petit-pied-bleu"). It is a winter species, developing and fructifying well in the cold weather. (July 2nd.) M. Albert Tissandier writes of the centenary of the Conservatoire of Arts and Crafts, which was celebrated on June 24th. The original plan of this Conservatoire is due to Descartes, who was anxious to establish a university where artisans and other craftsmen could be instructed; but many years passed away before his desire was realised. It was on May 15th, 1798 (26th Floréal), that the Council of the Cinq-Cents, acting on the report of Gregoire, decided to place at the disposal of the Executive Directory a great part of the ancient Priory of Saint Martin des Champs for the installation of a Conservatoire of Arts and Crafts. The article is accompanied by five illustrations of the plan of the buildings.

Bolletino dei Musei di Zoologia ed Anatomia Comparata della R. Universita di Torino (Turin, Nos. 311 to 319, 1898). A considerable portion of the space available in these numbers is occupied by an important paper by Dr. Ermanno Giglio-Tos, upon the Orthoptera from the rich zoological collection made by Dr. Enrico Festa in Ecuador, and presented to the Royal Zoological Museum at Turin. In all there are 206 species, 72 being new, with 13 new genera. They are divided among the following families: Blattidae 30, Mantidae 9, Phasmidae 23, Acrididae 56, Locustidae 74, Gryllidae 14. The only illustrations with this paper are of a mantis, *Phyllium geryon*, showing the sexes. A further paper on the same collection deals with some additional grasshoppers that are new, and described by Dr. Achille Griffini; they are included in the families Gryllidae and Locustidae. There are several new species among these also. Sig. Carlo Pallonera contributes an interesting paper on the land and freshwater shells found in Abyssinia by General di Boccard. There are a few new species and a plate with thirty-one well executed figures. The other papers are on "Decapod Crustacea from St. Thomas, West Indies," by Signor Giuseppe Nobili; on the small mammals collected by Dr. Borelli in Bolivia and Northern Argentina, by Mr. Oldfield Thomas. The district had been very little explored zoologically, so this collection of about twenty species, nearly half being bats, is interesting, though it contained nothing new. Dr. M. G. Peracca, of the Turin Museum, describes a new Italian Triton, or water-newt, new also to science, which he names *Molge italica*; a new beetle (*Thermonectes alfredi*) is also described by Dr. Griffini, from Bolivia and Argentina, with a figure.

Bulletin de la Société Philomatique de Paris (Vol. ix. Nos. 3 and 4). A paper on "Malacological Notes," by M. J. Mabille, is concluded. M. A. Lécaillon's paper on "The Endoderme of Insects" is the most important in these numbers It is the result of work done at the Laboratory of Comparative Embryology of the College of France.

The Selborne Society.—The members and friends of the Selborne Society (Croydon Branch) paid a visit to Hayes and Keston Commons on Saturday, July 9th, the occasion being favoured with lovely weather. Under the leadership of Mr. E. A. Martin, F.G.S., and Mr. A. E. Parnell, the party also visited Cæsar's Camp and the picturesque lakes in the neighbourhood, pushing on as far as the famous "Wilberforce Seat," where the great question of slave emancipation is said to have been discussed and decided upon by Pitt and Wilberforce. Tea was taken at Keston. The bracken, *Pteris aquilina*, was at its best on the common, and interspersed here and there were fine clusters of heather (*Erica cinerea* and *E. tetralix*), the common ling or heath (*Calluna vulgaris*) scarcely yet showing its blossoms. Dog-roses, honeysuckle, tormentil, mulleins, nipplewort, ivy-leaved lettuce (*Lactuca muralis*), yellow bedstraw, mountain groundsel (*Senecio syvaticus*), buck's-horn plantain (*Plantago coronopus*), and hoary cinquefoil (*Potentilla argentea*) were amongst the many flowers which were gathered. In the lakes the frogs were just taking to the land, many being seen with tails still unabsorbed.

Hull Scientific and Field Naturalists' Club.—A large party of members of this club left Hornsea in waggonettes for Atwick and Skipsea Brough on the afternoon of June 18th. After a pleasant drive to Skipsea Brough the party alighted, and under the guidance of Mr. Boyle inspected the remarkable mound and earthworks for which the place is so famous. After a steep climb, the summit of the central mound was reached, and from this elevated position a good view of the surrounding earthworks and the general aspect of the country could be obtained. Mr. Boyle then gave a most interesting lecture on the antiquities of the neighbourhood in general and the earthworks in particular. It would seem that the Skipsea Brough earthworks were most admirably constructed for what was in those days the most advantageous course to take during times of war, viz., a passive resistance rather than active aggression. The most marvellous thing in connection with these earthworks is their enormous size. With such implements as the ancient Britons had, it can hardly be conceived how they laid out the plan and built the structure. Notwithstanding the fact that 2,000 years have elapsed since the erection of these works, they are still in good condition, and it is not at all necessary to draw upon the imagination in order to prepare a restored plan of them. A brief stroll was then taken in the neighbourhood; the earthworks were again traversed and photographed, the members were taken to Atwick in waggonettes, and a very pleasant time was spent at that village. Mr. Morfitt and his sons took great pains to show their excellent collection of local geological specimens and antiquities. Such a collection is rarely seen, and doubtless Messrs. Morfitt have the best series of derived fossils—that is, fossils from different rocks which are found in the Boulder clay—in this part of the country. The collection of agates, consisting of several hundred specimens, and some of enormous size and beauty, were well shown in large bowls of water. But the Liassic ammonites, nautili, saurian remains, bivalves and also the gorgeous examples of Speeton clay, chalk and other fossils excited the admiration of all. A large and beautiful series of Carboniferous limestone corals was exhibited. Of more recent date, though none the less interesting, were the mammoth, deer, horse, ox and other remains from the coast and peat beds in the vicinity. Foremost among them should be mentioned the perfect skull and antlers of a *Cervus elaphus*, which had recently been discovered in the peat near Hornsea. Amongst the antiquities were various examples of ancient pottery, stone and bronze implements, all from the immediate neighbourhood. After a substantial tea kindly provided by Messrs. and Miss Morfitt, the party visited the cliffs, which at this point are unusually high, in search of the recently-discovered boulder of Shap granite. The members then reluctantly bid adieu to their host, and after another pleasant drive reached Hornsea. The fine weather, together with the variety of the afternoon's work, rendered the outing most profitable and enjoyable.—*T. Sheppard, Hon. Sec., 78, Sherburn Street, Hull.*

NOTICES OF SOCIETIES.

*Ordinary meetings are marked †, excursions *; names of persons following excursions are of Conductors.*

Conchological Society, London Branch.

Aug. 6.—*Hampton Wick. Train leaves Waterloo 2.40 p.m.
Hon. Sec., J. E. Cooper, 68, North Hill, Highgate, N.

Geologists' Association of London.

July 28 to Aug. 3.—*Birmingham district. Prof. Chas. Lapworth and others.
Sept. 10.—*Gravesend, Kent. G. E. Dibley, F.G.S.
Further particulars from *Horace W. Monckton, Hon. Sec. (Excursions), 10, King's Bench Walk, Temple, E.C.*

Lambeth Field Club and Scientific Society.

Aug. 1.—*Leith Hill.
" 27.—*Epping Forest (in conjunction with E. London Micro. and Nat. Hist. Soc.).
Sept. 18.—*Caterham.
" 20.—†"Dew." (With experiments.) J. J. Denton.
Hon. Sec., H. Wilson, 134, Abbeville Road. Clapham, S.W.

North London Natural History Society.

Aug. 1.—*Wicken Fen. W. Woodward.
" 4.—†"Notes on a Visit to South Africa." W. H. Barber.
" 6.—*Hayes, Kent. L. J. Tremayne.
" 18.—†Discussion: "Alpine Lepidoptera and their British Allies." Opened by R. W. Robbins.
Sept. 1.—†"The Microscopic Inhabitants of a Stagnant Ditch." C. Nicholson, F.E.S.
" 3.—*Epping Forest. The President.
" 15.—†Debate: "Are the Man and the Monkey descended from a common Ancestor?" Opened in the affirmative by A. Bacot; opened in the negative by B. S. James.
Oct. 6.—†Pocket Box Exhibition.
" 20.—†"Buttercups and their Allies; or, the Teachings of Systematic Botany as to Evolution." Prof. G. S. Boulger.
" 22.—*Visit to the Epping Forest Museum. Wm. Cole (Curator of the Museum).
Nov. 3.—†"Henry Walter Bates: his Life and Work." L. B. Prout, F.E.S.
" 17.—†Discussion: "The Origin of Migration in Animals." Opened by J. A. Simes.
Dec. 1.—†"Solitary Bees and Wasps." W. H. Smith.
" 15.—†General Business.
Visitors will be cordially welcomed at all meetings and excursions. *Lawrence J. Tremayne, Hon. Sec.*

Lincolnshire Science Society.

Sept. 3.—*Barkstone, for Syston and Belton Parks. Rev. E. Nelson, M.A.
" 21.—*Woodhall Spa: botany of the Moors; glacial beds.
Oct. 8.—*Torksey: Old Trent gravels. W. E. Asquith.
Hon. Sec., G. A. Grierson, F.L.S., 312, High Street, Lincoln.

NOTTINGHAM NATURAL SCIENCE RAMBLING CLUB.
Conductors of Rambles:
Geology, J. Shipman, F.G.S.; *Botany*, W. Stafford.
Aug. 13.—*Botany. Meet at Emmanuel Church, Woodborough Road, 2.30 p.m., for Lambley Dumbles.
„ 27.—*Geology. Meet at Sneinton Baths, 2.45 p.m., for Colwick for Bunter Pebble Beds, Keuper strata, etc.
Sept. 10.—*Botany. Meet at Lodge, Waverley Street entrance, to examine Arboretum and Pater Herbarium at University Museum.
Oct. 29.—†Annual Meeting and Exhibition, 4.15 p.m., Natural Science Laboratory, University College.
Hon. Sec., W. Bickerton, 187, Noel Street.

PRESTON SCIENTIFIC SOCIETY.
Aug. 20.—*Brock Bottoms.
Sept. 8.—*Ingleton.
W. Hy. Heathcote, F.L.S., Sec., 47, Frenchwood Street.

YORKSHIRE NATURALISTS' UNION.
July 29 to Aug. 1.—*Easington for Spurn Point.
Aug. 19.—†Annual Meeting at Scarborough.

METROPOLITAN SCIENTIFIC SOCIETIES.

The following is a list of societies in the London district devoted to natural science, with hours and places of meeting. They may be visited with introduction from a Fellow, Member, or Secretary. Will secretaries send additions or corrections.

ANTHROPOLOGICAL INSTITUTE OF GREAT BRITAIN, 3, Hanover Square. Second and fourth Tuesdays at 8.30 p.m., November to June.

BATTERSEA FIELD CLUB AND LITERARY AND SCIENTIFIC SOCIETY. Public Library, Lavender Hill, S.W. Thursdays, 8 p.m.

CITY OF LONDON COLLEGE SCIENCE SOCIETY, White Street, Moorfields, E.C. Last Wednesday in each month, October to May, 7.30 p.m.

CITY OF LONDON ENTOMOLOGICAL AND NATURAL HISTORY SOCIETY, London Institution, Finsbury Circus. First and third Tuesdays, 7.30 p.m.

CONCHOLOGICAL SOCIETY, LONDON BRANCH, St. Peter's Rectory, Walworth. Irregular meetings. Rev. J. W. Horsley, President, will answer enquiries.

CROYDON MICROSCOPICAL AND NATURAL HISTORY CLUB, Public Hall. Third Tuesdays, October to May, 8 p.m.

DULWICH SCIENTIFIC AND LITERARY ASSOCIATION. Fortnightly lectures Lordship Lane Hall, second and fourth Mondays, 8.15 p.m., from October, for winter season.

EALING NATURAL SCIENCE AND MICROSCOPICAL SOCIETY. Victoria Hall, Ealing. Second and last Saturdays. October to May, 8 p.m.

ENTOMOLOGICAL SOCIETY, 11, Chandos Street, Cavendish Square. First Wednesday, October to June (except January). Third Wednesday, January, February, March and November, 8 p.m.

GEOLOGISTS' ASSOCIATION, University College, Gower Street. First Friday, 8 p.m., November to July.

GEOLOGICAL SOCIETY OF LONDON, Burlington House, Piccadilly. First and third Wednesdays, 8 p.m., November to June.

GREENHITHE NATURALISTS' AND ARCHÆOLOGICAL SOCIETY, 7, The Terrace. First Fridays, 7 p.m.

LAMBETH FIELD CLUB AND SCIENTIFIC SOCIETY, St. Mary Newington Schools, Newington Butts, S.E. First Mondays all the year and third Mondays in winter, 8 p.m.

LINNEAN SOCIETY OF LONDON, Burlington House, Piccadilly. First and third Thursdays at 8 p.m., November to June.

LONDON AMATEUR SCIENTIFIC SOCIETY, Memorial Hall, Farringdon Street, E.C. Fourth Friday in each month, October to May, 7.30 p.m.

LUBBOCK FIELD CLUB. Working Men's College, Great Ormond Street, Bloomsbury, W.C. Excursions second Sundays, Meetings following Mondays, 8 pm.

MALACOLOGICAL SOCIETY OF LONDON, meets in Linnean Society's Rooms, Burlington House. Second Friday each month, November to June, 8 p.m.

MINERALOGICAL SOCIETY. Meets in rooms of Geological Society, February 4th, April 14th, June 23rd, November 17th, 8 p.m.

NONPAREIL ENTOMOLOGICAL AND NATURAL HISTORY SOCIETY, 99, Mansfield Street, Kingsland Road, N.E. First and third Thursdays, 8 p.m.

NORTH KENT NATURAL HISTORY AND SCIENTIFIC SOCIETY. St. John's Schools, Wellington Street, Woolwich. Alternate Wednesdays, 7.30 p m.

NORTH LONDON NATURAL HISTORY SOCIETY, North-East London Institution, Hackney Downs Station. First and third Thursdays, 7.45 p.m.

QUEKETT MICROSCOPICAL CLUB, 20, Hanover Square. First and third Fridays, 8 p.m.

ROYAL BOTANIC SOCIETY OF LONDON, Regent's Park. Second and fourth Saturdays at 3.45 p.m.

ROYAL HORTICULTURAL SOCIETY, 117, Victoria Street, S.W. Second and fourth Tuesdays, except December to February; 2 p.m. on show days, which vary.

ROYAL METEOROLOGICAL SOCIETY, 22, Great George Street, Westminster. 3rd Wednesday, November to June, 8 p.m.

ROYAL MICROSCOPICAL SOCIETY, 20, Hanover Square. Third Wednesdays, October to June, 8 p.m.

SELBORNE SOCIETY, 20, Hanover Square. No winter meetings.

SIDCUP LITERARY AND SCIENTIFIC SOCIETY, Public Hall, Sidcup. First and third Tuesdays, October to May, 8 p.m.

SOUTH LONDON ENTOMOLOGICAL AND NATURAL HISTORY SOCIETY, Hibernia Chambers, London Bridge, S.E. Second and fourth Thursdays, 8 p.m.

SUTTON SCIENTIFIC AND LITERARY SOCIETY, Public Hall Chambers. Second and forth Tuesdays, 8 p.m.

WEST KENT NATURAL HISTORY, MICROSCOPICAL AND PHOTOGRAPHIC SOCIETY. Meets in School for Sons of Missionaries, Blackheath, third Wednesday, in December, fourth Wednesdays in October, November, January February, March, April, May, 8 p.m.

ZOOLOGICAL SOCIETY OF LONDON, 3, Hanover Square. First and third Tuesdays, 8.30 p.m., November to August.

NOTICES TO CORRESPONDENTS.

TO CORRESPONDENTS AND EXCHANGERS.—SCIENCE-GOSSIP is published on the 25th of each month. All notes or other communications should reach us not later than the 18th of the month for insertion in the following number. No communications can be inserted or noticed without full name and address of writer. Notices of changes of address admitted free.

BUSINESS COMMUNICATIONS.—All Business Communications relating to SCIENCE-GOSSIP must be addressed to the NASSAU STEAM PRESS, LIMITED, 86, St. Martin's Lane, Charing Cross, W.C.

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Strictly Editorial communications, *i.e.*, such as relate to articles, books for review, instruments for notice, specimens for identification, etc., to be addressed to JOHN T. CARRINGTON, 1, Northumberland Avenue, London, W.C.

NOTICE.—Contributors are requested to strictly observe the following rules. All contributions must be *clearly* written on one side of the paper only. Words intended to be printed in *italics* should be marked under with a single line. Generic names must be given in full, excepting where used immediately before. Capitals may only be used for generic, and not specific names. Scientific names and names of places to be written in round hand.

THE Editor will be pleased to answer questions and name specimens through the Correspondence column of the magazine. Specimens, in good condition, of not more than three species to be sent at one time, *carriage paid*. Duplicates only to be sent, which will not be returned. The specimens must have identifying numbers attached, together with locality, date and particulars of capture.

THE Editor is not responsible for unused MSS., neither can he undertake to return them, unless accompanied with stamps for return postage.

EXCHANGES.

NOTICE.—Exchanges extending to thirty words (including name and address) admitted free, but additional words must be prepaid at the rate of threepence for every seven words or less.

WANTED, live eggs, larvae and pupae of Bath white butterfly (Pieris daplidice), bred or foreign, in their proper seasons.—Rev. H. A. Soames, Otford, Sevenoaks.

DUPLICATES.—Amalia gagates, Limax agrestis, Sphaerium corneum, Pisidium amnicum, fontinale, pusillum, nitidum, roseum, Unio tumidus, Paludina vivipara, Helix hortensis, nemoralis, virgata, caperata, etc. Desiderata numerous.—C. S. Coles, Hoe Moor House, Hambledon, Hants.

WANTED, grass snakes or very small tortoises in exchange for Privet larvae or microscopic slides.—W. H. Gaze, 42, Stafford Street, Norwich.

GOOD minerals and fossils from various formations in exchange for marine shells. Correspondence invited.—P. J. Roberts, 11, Back Ash Street, Bacup.

SLIDES OF ROTIFERA.—Asplanchnopus myrmeleo, Conochilus volvox, etc., and some excellent zoological mounts offered for British and foreign slugs in spirit or living.—G. E. Mason, 11b. Stanford Place, Fulham, London.

"BRITISH NATURALIST."—Several copies of vol. i. (New Series), all published in parts as issued, 15 plates, 300 pp., in exchange for works on biological subjects, or offers.—J. Cassin, 13, Grappenhall Road, Latchford, Warrington.

OFFERS requested for Crouch's student binocular microscope; best 2, 1, ½, ¼-inch objectives by Baker, Steward, Watson, extra large polariscope, spot lens and stand, bull's-eye condensor, double nose-piece and many accessories complete in best mahogany case; a good useful instrument, in first-class condition; cost £25.—J. E. Read, 37, St. Stephen's, Norwich.

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BRITISH MUSEUM NATURAL HISTORY